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CONTENTS

Effects of Several Fungicides For Seed Treatment of Corn ..... *R. G. Davide* 295

The Superiority in Grain Yield of Two Double-Cross Combinations Involving A107 And A111 × A113 Over College Yellow Flint ..... *I. S. Santos, B. L. Lit, and R. E. Abejuela* 306

Solvent-Process Extracted Copra Meal Vs. Expeller-Process Extracted Copra Meal in Poultry Rations ..... *F. M. Fronda, T. V. Katigbak, and R. Z. Ortigas* 314

The Breeding Habits of Berkshire Swine ..... *M. G. Quinto* 319

Palay Marketing Practices of Farmers in Gapan and San Antonio, Nueva Ecija, 1955-1956 ..... *V. U. Quintana* 327

The Expenditures of Incomes of 100 Families in Canlalay, Biñan, Laguna, 1955 ..... *G. R. Vega* 344

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EFFECTS OF SEVERAL FUNGICIDES FOR SEED TREATMENT OF CORN [1]

ROMULO G. DAVIDE

The fungicides Arasan, Granosan, Gy-cop, Phygon, PCNB, Phytomycin, Panogen, and the insecticide Dieldrin significantly increased the stands of yellow flint and white flint corn over the checks. Treatments with Arasan was the best, followed by Granosan, Gy-cop, Phygon, PCNB, Phytomycin, Panogen, and Dieldrin. No phytotoxic effects on the seedlings were observed.

Failure of corn seeds to produce adequate stands after sowing in the field is often due to seed rot and insect attack. Seed treatment with fungicide-insecticide combinations is a cheap and practical method of partial control.

American authorities on seed treatments claim that benefits of seed treatment are not obtained in every location every year because disease development is influenced by many factors, such as the variety grown, the condition of the soil and seeds, and the weather condition. Since the real quality of seeds cannot be determined by their appearance and weather cannot be forecast far in advance, the threat of loss is present if non-treated seeds are planted.

Koehler (1935) reported that injuries at the crown of seed corn resulted in loss of stand and yield and that the damage could have been partially overcome by treating the seeds with fungicides.

Haensler (1939) stated that seed treatment is beneficial to field corn whether little or no thinning or replanting is practised because every kernel is expected to yield a strong corn plant. Crally (1947) confirmed that seed treatments were particularly outstanding when soil conditions at planting were unfavorable to germination and to optimum growth of the seedling. Reddy and Rice (1942) also found that seed treatment was of little or no value when the seeds were planted in moist or dry soil which remained warm for several days.

[1] Central Experiment Station Contribution No. 1948. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture, from the College of Agriculture, March, 1957. Prepared in the Department of Plant Pathology under the direction of former Visiting Cornell Professor Charles S. Reddy.

Better results were obtained when the seeds were planted in slightly dry soil that remained cold for several days.

Crosier (1952) declared that seed treatment does not guarantee disease-free crops. It must be supplemented with sensible cultural methods such as well-planned crop rotations and the choice of disease-resistant varieties.

Reddy and Holbert (1928) stated that fungicide dust treatments for sweet corn diseases were more consistently beneficial, more easily applied, and involved less risk of injury to the seeds than liquid treatments such as Uspulun, Semesan, and Mercury A.

Duffield (1952), in studying the compatibility of fungicides with insecticides, observed that Dieldrin in an emulsion formulation appeared to interact with Arasan when the treatment was made 12 weeks prior to the planting of corn. However, when Dieldrin and Arasan were applied just before planting, there was an indication of plant stimulation.

According to Hoppe (1948), mercurial treatments were injurious to corn seeds when pericarp injuries occurred near the embryo.

The present work was undertaken to determine which fungicide retards or enhances germination and which gives the best protection and largest increase in stands of corn. The study was conducted in the Plant Breeding field and Plant Pathology laboratory, College of Agriculture, College, Laguna, from December 10, 1955 to November 19, 1956.

MATERIALS AND METHODS

The white flint and yellow flint corn seeds were obtained from the Division of Plant Breeding, Department of Agronomy. The fungicides and insecticides used were:

1. Arasan.—Contains 50 per cent Thiram (tetra-methylthiuram disulfide) as active ingredient. A product of E. I. Du Pont De Nemours & Co., Inc.

2. Granosan.—Contains five per cent mercury-phosphate and total metallic mercury 3.8 per cent as active ingredients; 95 per cent inert ingredients. A product of E. I. Du Pont De Nemours & Co., Inc.

3. Phygon.—Contains 50 per cent 2, 3-dichloro-1,4-naphthoguinone as active ingredient. A product of United States Rubber Co.

4. Panogen.—Contains 2.2 per cent Methyl mercury Dicyandiamide as active ingredient. A product of Panogen, Inc.

5. Gy-cop.—Contains 53 per cent copper as active ingredient; inert ingredients, 47 per cent. A product of Geigy Co., Inc.

6. PCNB.—Contains 75 per cent Pentachloroparanitro-benzene as active ingredient. A product of John Powel & Co.

7. Phytomycin.—Contains 20 per cent streptomycin (as nitrate) as active ingredient; inert ingredients, 80 per cent. A product of Olin Mathieson Chemical Corp.

8. Dieldrin.—Contains 50 per cent Wettable Powder as active ingredient. A product of Shell Co., Ltd.

The dosages used were those recommended by the manufacturer of each chemical. These figures, in ounces per bushel, were converted into grams per kilogram of corn seeds.

The dry-season experiment was conducted from December 30, 1955 to January 19, 1956. In this experiment 1,000 kernels weighing 0.252 kilogram, were placed in each flask and the desired amount of the fungicide under test was added. The seed treatment materials were applied as dust except for Phytomycin and Panogen which were applied as liquid. The seven flasks were each thoroughly agitated until the seeds were uniformly coated and no more dust materials settled at the bottom. Then the recommended amount of the insecticide Dieldrin was put into each flask with fungicide and agitated again. The eighth flask contained only Dieldrin.

The seeds were planted a day after the treatment in five randomized blocks, each block consisting of nine rows one-half meter apart with seeds planted one to two inches deep and three inches apart in each row. One hundred seeds were planted to a row. One row in each block was used as check.

In the wet-season experiment, conducted from June 8, 1956 to June 22, 1956, the same method and the same amount of seeds were used except that the recommended amount of Dieldrin was mixed instead with fine sand and spread over the plots.

The effects of seed treatments against root rot and insect damage were evaluated on the basis of total seedling emergence. In the first experiment, first germination counts were made 10 days after planting and the second stand counts, 10 days later. In the second experiment, the first count was made four days after planting and the second, eight days after planting.

In both experiments the first counts were made to determine which fungicide enhanced or retarded emergence. The stand counts were used to determine which fungicide gave the best protection and highest increase in stands of corn. Frequent observations and notes on wet spots in the field were made.

Two flood tests, developed by Dr. Charles S. Reddy, were conducted after the second experiment in the field and in seed boxes under the shade. The seeds used in the tests came from the excess of the second experiment. In the first test, eight tumblers were filled with 100 treated seeds each and the same number of non-treated seeds was used as check. A teaspoonful of air-dry soil taken from the field where the experiments were conducted was thoroughly mixed with the seeds in each tumbler. The seeds were moistened with four cc. of tap water to insure thorough coating of the seeds with the soil so that soil-borne pathogens could have a chance to infect the seeds. Two-thirds of the tumbler was filled with fine sand to prevent the seeds from floating when water was gently poured into the tumbler. The seeds were submerged at room temperature for three days before they were planted in nine 18″ × 12″ × 4″ seed boxes filled with sand. The ninth seed box was used as check. The same number and interval of stand counts was made.

In both tests, the first stand counts were used to determine which of the treatments retarded germination; the second served to determine the best seed treatment for protection and stand establishment.

RESULTS AND DISCUSSION

First experiment. The preplanting germination test showed 92 per cent emergence for white flint corn and 96 per cent for yellow flint corn. The newly planted corn seeds were watered five times at two-day intervals to insure maximum germination. Emergence, however, was slow and very uneven so that some of the plants were still emerging two weeks after planting.

For white flint corn, emergence counts for the first experiment 10 days after planting showed that Panogen at the rate of 0.75 ml. in 6 cc. of water for every kilogram of seeds gave the best emergence, followed by Arasan at 0.83 gram for every kilogram of seeds, Granosan at 1.12 grams for every kilogram of seeds, PCNB at 3.35 grams for every kilogram of seeds, Dieldrin at 3.34 grams for every kilogram of seeds, Phygon at 0.62 for every kilogram of seeds, Phy-

tomycin at one ml. for every kilogram of seeds in 6 cc. of water, and Gy-cop at 2.23 grams for every kilogram of seeds. However, the differences between treatments were insignificant.

The final stand counts showed that Panogen had the highest stands, followed by Granosan, Gy-cop, PCNB, Phygon, Arasan, Phytomycin, and Dieldrin. There were no significant differences between chemical treatments. However, all eight chemical treatments were significantly better than the check (table 1).

TABLE 1.—*Final stand counts of white flint corn seedlings twenty days after planting (dry season)*

TREATMENT	DOSAGE (gm./kgm. of seeds)	REPLICATION I	II	III	IV	V	TOTAL	AVERAGE	PER CENT OF BEST
Panogen	0.194 ml. per 1.16 ml. H_2O	91	82	92	82	80	427	85.4	100
Granosan	0.289	82	79	89	88	83	421	84.2	98.6
Gy-cop	0.653	82	87	86	84	80	419	83.8	98.1
PCNB	0.844	84	82	79	80	82	407	81.4	95.3
Phygon	0.160	79	81	84	80	82	406	81.2	95.1
Arasan	0.214	82	80	80	84	80	406	81.2	95.1
Phytomycin	0.258 ml. per 1.548 ml. H_2O	79	80	79	78	80	396	79.2	92.7
Dieldrin	0.864	82	79	80	73	76	390	78.0	91.3
Control		77	75	67	70	71	360	72.0	84.3
Total		738	725	736	719	714	3632		

SMD at 5% = 4.22
1% = 5.63

For the yellow flint corn, the first stand counts 10 days after planting showed that PCNB treated seeds gave the highest emergence counts, followed by Phytomycin, Gy-cop, Panogen, Phygon, Granosan, Arasan, and Dieldrin. The differences between treatments were highly significant. In the final stand counts, Granosan gave the highest average stand followed by Phygon, Panogen, PCNB, Gy-cop, Phytomycin, and Arasan (table 2). All the treatments except that for Dieldrin were significantly better than the check.

There were more vigorous plants than weak and stunted plants in all treatments, although there were no distinct differences in the number of poor and good plants between treatments. The seeds were attacked by fungi namely, *Penicillium* sp., *Fusarium moniliforme* Sheldon, and *Aspergillus niger* Van Tiegh.[2] The same seed rot pa-

[2] Identified by Assistant Professor V. M. Ela of the Department of Plant Pathology.

TABLE 2.—*Final stand counts of yellow flint corn seedlings twenty days after planting (dry season)*

TREATMENT	DOSAGE (gm./kgm. of seeds)	REPLICATION					TOTAL	AVERAGE	PER CENT OF BEST
		I	II	III	IV	V			
Granosan	0.289	97	96	92	94	96	475	95.0	100
Phygon	0.160	98	90	94	98	94	474	94.8	99.8
Panogen	0.194 ml. per 1.161 ml. H_2O	97	90	97	92	94	470	94.0	98.9
PCNB	0.844	94	92	90	93	98	467	93.4	98.3
Gy-cop	0.653	92	96	94	90	93	465	93.0	97.9
Phytomycin	0.258 ml. per 1.548 ml. H_2O	98	94	92	90	90	464	92.8	97.7
Arasan	0.214	90	87	95	91	91	454	90.8	95.6
Dieldrin	0.864	91	89	90	81	86	437	87.4	92.0
Control		90	89	80	82	91	432	86.4	90.9
Total		847	823	835	809	824	4138		

SMD at 5% = 3.97
1% = 5.33

thogens were reported by Melchers and Brunson (1934) as most common in untreated corn seeds in Kansas.

Second experiment. The preplanting germination test showed 90 per cent emergence for white flint corn and 95 per cent for yellow flint corn. The conditions at the time of planting were favorable for germination.

The first stand counts of the white flint corn four days after planting showed that Phytomycin treatment gave the highest emergence percentage, followed by Granosan, Phygon, Arasan, PCNB, Gy-cop, and Panogen treatments. There were no significant differences between treatments. The final stand counts showed that Phytomycin and Granosan were equal and higher than any other treatment. However, analysis of variance showed that the differences between fungicidal treatments were insignificant (table 3). Dieldrin was not significantly lower than the checks.

The first stand counts of yellow flint corn revealed that PCNB gave the highest average count, followed by Phytomycin, Granosan, Gy-cop, Arasan, Dieldrin, Panogen, and Phygon. All the treatments except Phygon were significantly better than the checks. Dieldrin gave higher emergence counts than Panogen and Phygon but the difference was insignificant. PCNB gave the highest final stand counts 10 days after planting, followed by Granosan, Phytomycin, Arasan,

Panogen, Phygon, Dieldrin, and Gy-cop. All treatments were significantly better than the checks (table 4).

TABLE 3.—*Final stand counts of white flint corn seedlings ten days after planting (wet season)*

TREATMENT	DOSAGE (gm./kgm. of seeds)	REPLICATION I	II	III	IV	V	TOTAL	AVERAGE	PER CENT OF BEST
Phytomycin	0.258 ml. per 1.548 ml. H_2O	84	89	88	91	89	441	88.2	100
Granosan	0.289	80	88	92	93	88	441	88.2	100
Arasan	0.2142	80	90	85	90	90	435	87.0	98.6
Phygon	0.1599	81	86	90	80	96	433	86.6	98.2
PCNB	0.8443	86	88	88	86	84	432	86.4	97.9
Gy-cop	0.6527	82	82	93	86	89	432	86.4	97.9
Panogen	0.1935 ml. per 1.161 ml. H_2O	78	87	90	86	89	430	86.0	97.5
Dieldrin	0.8643	85	86	68	83	85	407	81.0	92.3
Control		78	86	84	86	80	414	82.8	93.9
Total		734	782	778	781	790	3865		

TABLE 4.—*Final stand counts of yellow flint corn seedlings ten days after planting (wet season)*

TREATMENT	DOSAGE (gm./kgm. of seeds)	REPLICATION I	II	III	IV	V	TOTAL	AVERAGE	PER CENT OF BEST
PCNB	0.8445	92	97	94	92	94	469	93.8	100
Granosan	0.2889	94	91	93	91	85	454	90.8	96.8
Phytomycin	0.258 ml. per 1.548 ml. H_2O	98	93	94	85	89	459	91.8	97.9
Arasan	0.2142	92	82	95	86	97	452	90.4	96.4
Panogen	0.1935 ml. per 1.16 ml. H_2O	93	93	82	95	87	450	90.0	95.7
Phygon	0.1599	90	89	87	92	89	447	89.4	95.3
Dieldrin	0.8643	88	93	88	90	86	445	89.0	94.9
Gy-cop	0.6427	88	92	90	88	86	444	88.8	94.7
Control		76	72	79	80	73	380	76.0	81.0
Total		811	802	802	799	786	4000		

SMD at 5% = 5.15
1% = 6.92

Flood test under field conditions. The field flood test showed that in white flint corn Granosan gave the highest average stand counts, followed by Phygon, Arasan, and PCNB. All the treatments showed marked increase in average stand counts as compared to the checks (table 5).

In yellow flint corn, Arasan showed the highest average stand counts, followed by Gy-cop, Phygon, and Granosan. All treatments also gave higher average stand counts than the check (table 6).

TABLE 5.—*Results of flood test of white flint corn (100 seeds planted in the field)*

TREATMENT	DOSAGE [a] (gm./kgm. of seeds)	FIRST COUNT AT 4-DAY OLD	SECOND COUNT AT 8-DAY OLD	AVERAGE	PER CENT OF BEST
Granosan	0.2889	87	88	87.5	100
Phygon	0.1599	75	80	77.5	88.6
Arasan	0.2142	70	80	75.0	85.7
PCNB	0.8443	72	72	72.0	82.3
Dieldrin	0.8643	68	74	71.0	81.0
Gy-cop	0.6527	68	72	70.0	80.0
Phytomycin	0.258 ml. per 1.548 ml. H_2O	70	70	70.0	80.0
Panogen	0.1935 ml. per 1.16 ml. H_2O	55	60	57.5	65.7
Control		44	47	45.5	52.0

[a] Based on 0.255 kilogram, the weight of 1000 seeds.

TABLE 6.—*Results of flood test of yellow flint corn (100 seeds planted in the field)*

TREATMENT	DOSAGE [a] (gm./kgm. of seeds)	FIRST COUNT AT 4-DAY OLD	SECOND COUNT AT 8-DAY OLD	AVERAGE	PER CENT OF BEST
Arasan	0.2142	73	75	74	100
Gy-cop	0.6527	69	70	69.5	93.9
Phygon	0.1599	64	70	67.0	90.5
Granosan	0.2889	59	69	64.0	86.5
PCNB	0.8443	61	66	63.5	85.8
Phytomycin	0.258 ml. per 1.548 ml. H_2O	63	64	63.5	85.8
Panogen	0.1935 ml. per 1.16 ml. H_2O	59	59	59.0	79.2
Dieldrin	0.8643	47	52	49.5	66.9
Control		14	18	16.0	21.6

[a] Based on 0.255 kilogram, the weight of 1000 seeds.

Flood test under shade conditions. Based on the average stand counts of white flint corn, Arasan treatment proved to be the best, followed by Gy-cop, Granosan, and Phygon. All eight treatments markedly increased the average stand counts over the checks (table 7).

In the case of yellow flint corn, Arasan gave the highest stand counts, followed by Gy-cop, Phygon, and Granosan treatments. All treatments also gave higher stand counts than the checks (table 8).

Duffield (1952) and Floyd and Smith (1953) advocated the inclusion of fungicides with insecticides in seed treatments, since corn seed injury may be caused by both fungi and insects. In this study Dieldrin proved effective against insect attack.

TABLE 7.—*Results of flood test of white flint corn (100 seeds planted in seed boxes under shade conditions)*

TREATMENT	DOSAGE [a] (gm./kgm. of seeds)	FIRST COUNT AT 4-DAY OLD	SECOND COUNT AT 8-DAY OLD	AVERAGE	PER CENT OF BEST
Arasan	0.2142	70	97	88.5	100
Gy-cop	0.6527	69	96	82.5	93.2
Granosan	0.2889	68	95	81.5	92.1
Phygon	0.1599	68	87	77.5	87.6
Phytomycin	0.258 ml. per 1.548 ml. H_2O	67	77	72.0	81.4
Panogen	0.1935 ml. per 1.16 ml. H_2O	64	78	71.0	80.2
PCNB	0.8443	59	81	70.0	79.1
Dieldrin	0.8643	60	76	68.0	76.8
Control		49	74	61.5	69.5

[a] Based on 0.255 kilogram of seeds.

TABLE 8.—*Results of flood test of yellow flint corn (100 seeds planted in seed boxes under shade conditions)*

TREATMENT	DOSAGE [a] (gm./kgm. of seeds)	FIRST COUNT AT 4-DAY OLD	SECOND COUNT AT 8-DAY OLD	AVERAGE	PER CENT OF BEST
Arasan	0.2142	86	99	92.5	100
Gy-cop	0.6529	81	93	87.0	94.1
Phygon	0.1599	75	87	81.0	87.6
Granosan	0.2889	72	86	79.0	85.4
Panogen	0.1935 ml. per 1.16 ml. H_2O	74	82	78.0	84.3
Phytomycin	0.258 ml. per 1.548 ml. H_2O	60	80	70.0	75.7
PCNB	0.8443	57	81	69.0	74.6
Dieldrin	0.8643	56	65	60.0	65.4
Control		52	72	62.0	67.0

[a] Based on 0.255 kilogram of seeds.

In the four experiments with white flint and yellow flint corn, seven fungicidal treatments gave varied stand increases ranging from 23 to 35 per cent. The average increase for the seven tratments was 29 per cent. In the same experiments the insecticide treatment alone increased stand by 16 per cent (table 9).

TABLE 9.—*Summary of tables 1, 2, 3, 4, 5, 6, 7, and 8 showing the mean number of plants from lots of 100 seeds in four field tests and four flood tests using white and yellow flint corn seeds*

ARASAN	GRANOSAN	GY-COP	PHYGON	PCNB	PHYTO-MYCIN	PANOGEN	DIELDRIN	CONTROL
81.2	84.2	83.8	81.2	81.4	79.2	85.4	78.0	72.0
90.8	95.0	93.0	94.8	93.4	92.8	94.0	87.4	86.4
87.8	88.2	86.4	86.6	86.4	88.2	86.0	91.4	82.8
90.4	90.8	88.8	89.4	93.8	91.8	90.0	89.0	76.0
75.0	87.5	70.0	77.5	72.0	70.0	57.5	71.0	45.5
74.0	64.0	69.5	67.0	63.5	63.5	59.0	49.5	16.0
88.5	81.5	82.5	77.5	70.0	72.0	71.0	68.0	61.5
92.5	79.0	87.0	81.0	69.0	70.0	78.0	60.5	62.0
679.4 [a]	670.2	661	655	629.5	627.5	620.9	548.8	582.2
100 [b]	98.6	97.3	96.4	92.7	92.4	91.4	86.1	73.9

[a] Total of the averages of the 8 experiments.
[b] Per cent of best.

All seven fungicides showed significantly better stand counts than the checks. However, other factors such as the chemical stability of each fungicide and its liability to cause injury under storage condition must be considered before it is used as treatment for corn seeds. Arasan gave the best stand counts. This fungicide has been widely used in other countries particularly in the United States because it is not injurious to the germination of the seed when treated several months before planting. Granosan, a mercurial fungicide, ranked second. Several experiments using Granosan for seed treatment of corn in the United States showed that it adversely affects the germination of seeds if kept long in storage before planting. Hence, planting should follow immediately after treatment. Gy-cop ranked third; however, its effects on yield have not yet been determined and usually copper fungicides are injurious to corn. Phygon ranked fourth. This fungicide has also been widely used in the United States and is as good as Arasan in increasing stand and yield. PCNB came out fifth. This fungicide has not yet been used widely in other countries for seed treatment of corn for yield test, but appears promising on the basis of the results of the present study. Phytomycin, an antibiotic, was sixth. There are not enough experiments to show its effects on vigor and yield; hence, it should be tested further as a seed treatment chemical. Panogen, a mercurial fungicide, came out seventh. In the present work, it increased stands significantly, but like Granosan and other mercurial fungicides, it is not stable in the soil and may lower the germination of

seed if treated seeds are allowed to stay long in storage after treatments.

On the basis of the overall results of these experiments, Arasan and Phygon may be recommended for seed treatment of corn under Philippine conditions.

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In a moral point of view, the life of the agriculturist is the most pure and holy of any class of men; pure, because it is the most healthful, and vice can hardly find time to contaminate it; and holy, because it brings the Deity perpetually before his view, giving him thereby the most exalted notions of supreme power, and the most endearing view of the divine benignity.

—*Lord John Russell*

THE SUPERIORITY IN GRAIN YIELD OF TWO DOUBLE-CROSS COMBINATIONS INVOLVING A107 AND A111 × A113 OVER COLLEGE YELLOW FLINT [1]

I. S. Santos, B. L. Lit, and R. E. Abejuela

Philippine Hybrid Nos. 1a and 1b were superior in grain yield to College Yellow Flint, a high-yielding open-pollinated variety, when planted at different dates during the regular planting season and during the off season. Even at their worst they were as good, if not a little better than College Yellow Flint.

On April, 1956 the Philippine Seed Board approved the release of four yellow corn hybrids. These were numbered 1, 3, 5, and 7, respectively. Philippine Hybrid No. 1 consisted of four hybrids differing from each other by a single inbred. Philippine Hybrid No. 3 consisted of two hybrids also differing from each other by a single inbred.

These recommendations were based on the performance data of these hybrids for the 1954 Wet Season, 1954-1955 Dry Season, and 1955 Wet Season, at one or more locations. Normally, at least five seasons of testing are necessary before recommendations are made but due to the great demand for hybrid corn seeds, it was found urgent to decide which hybrid to put out after only three-season tests.

Before the Seed Board released the four hybrids, two of the four hybrids listed under Philippine Hybrid No. 1 were included in the advance tests performed at the Central Experiment Station of the U.P. College of Agriculture. The object was to ascertain the superiority of these hybrids over College Yellow Flint. The two tests involved the period between November, 1955 and February, 1957.

MATERIALS AND METHODS

Experiment 1

The entries consisted of three promising double-crosses: (A103 × A107) (A111 × A113), (192 × A112) (A102 × A103), and (117 × 188) (A111 × A113), and College Yellow Flint, a high-yielding

[1] Central Experiment Station Contribution No. 1949.

open-pollinated variety. Inbreds A102, A103, and A107 are from College Yellow Flint. Inbreds A111, A112, and A113 are from Cuban Yellow Flint. Inbred 192 was obtained from South America by the Rockefeller Foundation. Inbred 117 was derived from F6; 118, from F44. F6 and F44 are standard inbred lines in Florida, U.S.A. Hybrid (A103 × A107) (A111 × A113) has been designated as Philippine hybrid No. 1b. For convenience (192 × A112) (A106 × A103) will be designated as 1c and (117 × 118) (A111 × A113) as 1d.

The essential points in the method of culture may be tabulated as follows:

Experiment 1:

Layout: 4 × 4 latin square
Size of plots: 5 × 4.5 m.
Distance of hills: 1 × 0.5 m.
Plants to a hill: 2
Fertilizer: Ammonium phosphate (16-0-0) at 250 kilos/ha.

Experiment 2:

Layout: simple randomized complete block
Size of plots: 3 × 10 m.
Distance of hills: 1 × 0.5 m.
Plants to a hill: 2
Fertilizer: Ammonium sulfate (20-0-0) at 250 kilos/ha.

EXPERIMENTAL RESULTS

Experiment 1

Table 1 summarizes the data on grain yield for all plantings. In all the plantings, the yields of (A103 × A107) (A111 × A113) and of (192 × A112) (A102 × A103) were approximately the same. Even their over-all means, 48.9 and 49.9 cavans per hectare, respectively, were very similar. These two hybrids yielded higher than College Yellow Flint in almost every case. The yield of hybrid (117 × 118) (A111 × A113) in the various plantings varied greatly in relation to those of the other entries. In the November 10, 1955 planting, this hybrid significantly outyielded College Yellow Flint and (A103 × A107) (A111 × A113) at the 0.01 level, and (192 × A112) (A102 × A103) at the 0.05 level. In both plantings of November 23, 1955 this hybrid yielded higher than College Yellow Flint but the difference was not statistically significant. In the December 7, 1955 planting, this hybrid yielded significantly lower than the other entries, including College Yellow Flint. It yielded lower

TABLE 1.—*Summary of grain yields (cavans per hectare) in all plantings, Experiment 1*

PLANTING	ENTRY [a]				MEAN	C.V.	S.M.D.		RAINFALL mm.[b]	AGE AT HARVEST
	1b	1c	1d	CYF			0.05	0.01		
Nov. 10, 1955	67.4	73.0	81.1	54.9	69.1	6.8	7.6	10.9	456	97
Nov. 23, 1955 (A)	53.5	52.4	40.9	36.1	45.8	10.6	8.4	12.8	376	100
Nov. 23, 1955 (B)	49.4	51.9	45.3	39.3	46.5	11.7	—	—	376	100
December 7, 1955	29.3	29.4	21.4	26.8	26.1	11.2	5.1	—	85	103
May 7, 1956 [c]	—	—	—	—	—	—	—	—	580	91
May 21, 1956	45.0	42.8	36.7	42.8	41.8	15.5	—	—	640	91
June 13, 1956	4.5	3.4	1.6	2.7	3.1	31.6	1.2	—	833	86
Mean	41.5	42.2	37.8	33.8	38.7	14.6	—	—	—	—
Mean [d]	48.9	49.9	45.1	40.0	45.9	11.2	—	—	—	—

[a] 1b = (A103 × A107) (A111 × A113)
1c = (192 × A112) (A102 × A103)
1d = (117 × 118) (A111 × A113)
CYF = College Yellow Flint.

[b] From planting to 30 days after silking of latest maturing entry. The number of days is given in the last column.

[c] Downy mildew practically wiped out all the corn plants. No yield data were taken.

[d] Excluding the data from the June 13, 1956 planting.
SMD at 5% = 3.2 cavans per hectare
at 1% = 4.3 cavans per hectare

These S.M.D.'s are based on the pooled error variance recalculated from the pooled error sum of squares and pooled degrees of freedom in the five plantings.

than College Yellow Flint in the May 7, 1956 and June 13, 1956 plantings but not significantly so. In the over-all mean, excluding the data from the June 13, 1956 planting, it came out still significantly better in grain yield than College Yellow Flint.

The coefficients of variability were all reasonable, except that obtained in the June 13, 1956 planting which was greater than 15 per cent, commonly considered as acceptable for corn grain yield.

The downy mildew infection in the dry season of 1955-56 was not severe, the maximum percentage of infection being 6.1 (table 2). This was exhibited by (192 × A112) (A102 × A103) in the last planting (December 7, 1955) of the 1954-55 dry season. Likewise, in that planting the mean (4.9 per cent) for all the entries was highest.

In the May 7, 1956 and June 13, 1956 plantings, downy mildew was very severe. Infection was close to 100 per cent in the former; in the latter, infection varied from 83.3 to 92.4 per cent. In the May 21, 1956 planting, the mean infection for all entries was 34.8 per cent, the variation being from 18.5 to 54.2 per cent. It was in this planting that the relative susceptibility of (117 × 118) (A111 × A113) and the relative resistance of College Yellow Flint to the disease was seen. In the June 13, 1956 planting the relative susceptibility of (117 × 118) (A111 × A113) to downy mildew was also indicated. In this planting, College Yellow Flint was as susceptible as the other two hybrids.

The over-all means indicated that (117 × 118) (A111 × A113) had the highest percentage of downy mildew infection. The other two hybrids and College Yellow Flint had about the same over-all mean percentages.

The highest mean grain yield of all four entries was obtained in the November 10, 1955 planting when total rainfall was 456 millimeters and downy mildew infection was very negligible. Although downy mildew infection increased by only 0.3 per cent in the November 23, 1956 planting, mean grain yield decreased by 23.0 cavans per hectare, a decrease of 33 per cent.

In the December 7, 1955 planting, downy mildew increased over the first planting by 4.1 per cent. The corresponding decrease in grain yield was 43.0 cavans per hectare, or 62.2 per cent. In these dry-season crops, it was clear that the slight increases in downy mildew infection could hardly be responsible for the large decreases in grain yield. The decrease in total amount of rainfall of 80 milli-

TABLE 2.—*Summary of downy mildew infection percentages of infected plants in all plantings, Experiment 1*

PLANTING	ENTRY [a]				MEAN	C.V.	S.M.D.	
	1b	1c	1d	CYF				
November 10, 1955	0.3	0.6	1.7	0.8	0.8	—	—	—
Nov. 23, 1955 (A)	0.0	2.3	2.1	1.5	1.5	—	—	—
Nov. 23, 1955 (B)	0.3	0.3	1.7	0.0	0.6	—	—	—
Dec. 7, 1955	4.1	6.4	5.3	3.9	4.9	—	—	—
May 7, 1956	97.2	99.2	96.6	98.0	98.0	1.6	—	—
May 21, 1956	34.7	31.6	54.2	18.5	34.8	25.7	15.5	23.5
June 13, 1956	85.5	84.9	92.4	83.3	86.5	5.0	—	—
Mean	31.7	32.2	36.6	29.2	32.4	—	—	—

[a] 1b = (A103 × A107) (A111 × A113)
1c = (192 × A112) (A102 × A103)
1d = (117 × 118) (A111 × A113)
CYF = College Yellow Flint

meters from the first to the second date of planting should probably account for the better part of the 33 per cent decrease in grain yield than the 0.3 per cent increase in downy mildew infection. Eighty millimeters of rainfall, however, could still seem too small an amount to cause such a large decrease in grain yield. The large decrease in grain yield from the first to the third date of planting is easier to explain on the basis of the large decrease in rainfall which was 370 millimeters. The insufficient amount of rainfall especially during the flowering time could account for the large decrease in grain yield.

In the wet season (1956), the downy mildew infection had the greater influence on grain yield than any other factor. The May 21, 1956 planting gave almost as high a grain yield as the November 23, 1955 planting in spite of the 34.8 per cent downy mildew infection in the former. The beneficial effect of the additional rainfall in the former planting on grain yield compensated for the detrimental effect of the high downy mildew infection. Soil difference may be ruled out since the two plantings were placed on the same type of land.

College Yellow Flint was the earliest maturing; (117 × 118) (A111 × A113), the latest maturing. The other two hybrids were intermediate, (192 × A112) (A102 × A1o3) maturing later by only two days than (A103 × A107) (A111 × A113).

Experiment 2

Table 3 is a summary of grain yield and of downy mildew infection percentages in each of the plantings. Amount of rainfall and

number of days from planting to 30 days after silking of latest-maturing entry in each planting are also given. College Yellow Flint was the earliest-maturing entry; Cuban Yellow Flint, the latest-maturing entry. The hybrid was intermediate in maturity to the two-open-pollinated varieties being about three to five days later than College Yellow Flint and three to five days earlier than Cuban Yellow Flint.

Where grain yields were obtained, the hybrid yielded higher than either of the two open-pollinated varieties and significantly so in most cases. The mean squares for entry were not significant in the February, April, and October plantings. Yields were low in the January 14, 1956 planting and this was due to the very low amount of rainfall during the growing period since there was no downy mildew infection. Even under such an adverse condition, (A102 × A107) (A111 × A113) significantly outyielded both open-pollinated varieties. Although statistical significance involving very small differences is of no practical value, the fact that the hybrid performed better than the varieties indicates that this hybrid is an efficient utilizer of soil moisture.

TABLE 3.—*Summary of grain yields (cavans per hectare) and percentages of downy mildew infection of the three entries at each date of planting, Experiment 2*

PLANTING	GRAIN YIELD [a]			DOWNY MILDEW [a]			RAINFALL [b]		AGE AT HARVEST [c]
	A	B	C	A	B	C	mm.	inches	
Jan. 14, 1956	0.6	3.3	0.7	0.0	0.0	0.0	164	3.4	105
Feb. 14, 1956	36.9	67.1	29.1	3.8	6.2	9.6	436	17.2	120
March 14, 1956	56.3	103.4	69.5	41.5	26.3	32.7	372	14.6	111
April 14, 1956	62.0	117.8	66.2	36.8	46.5	11.7	583	22.9	101
May 22, 1956	85.6	121.3	78.4	11.3	22.0	26.1	408	16.1	89
June 14, 1956 [d]	—	—	—	100	100	100	—	—	—
July 21, 1956	4.2	7.5	2.1	98 [e]	98 [e]	98 [e]	827	32.6	98
August 13, 1956	21.8	42.4	18.6	70 [e]	70 [e]	70 [e]	737	30.3	100
Sept. 27, 1956	29.6	55.8	25.7	60 [e]	60 [e]	60 [e]	618	24.4	93
Oct. 23, 1956	39.8	56.0	30.9	18.3	32.7	24.8	672	26.5	102
Nov. 10, 1956	56.0	84.8	54.1	20.2	23.4	32.9	633	24.9	96

[a] A = College Yellow Flint; B = (A102 × A107) (A111 × A113); C = Cuban Yellow Flint.

[b] Total rainfall from planting to 30 days after silking of latest-maturing entry.

[c] Number of days from planting to 30 days after silking of latest-maturing entry.

[d] No data were taken. Downy mildew infection reached almost 100 per cent.

[e] Estimated infection for all three entries.

In the March, April, and May plantings, yields were high in spite of the high precentages of downy mildew infection.

The June planting was wiped out and the yields in the July planting were low due to the high percentage of downy mildew infection. Even at this low level, the hybrid again significantly outyielded the two varieties. The very frequent rains favored the development of the disease.

Table 4 shows the yields of the three entries in the plantings wherein the error variances were found homogenous by the Bartlett's chi-square test.[3] The means based on the six plantings showed the superiority of the hybrid over the two varieties. The hybrid significantly outyielded both varieties at the 0.01 level; the two varieties did not significantly differ from each other in grain yield.

TABLE 4.—*Summary of grain yields (cavans per hectare) in the six plantings*

PLANTING	ENTRY [a]			DATE Mean	S-SQUARE [2]
	A	B	C		
March 14, 1956	56.3	103.4	69.5	76.4	43.48
May 22, 1956	85.6	121.3	78.4	95.1	15.32
August 13, 1956	21.8	42.4	18.6	27.6	5.04
September 27, 1956	29.6	55.8	25.7	37.0	11.78
October 23, 1956	39.8	56.0	30.9	42.2	10.18
November 10, 1956	56.0	84.8	54.1	64.9	10.58
Entry Mean	48.2	77.3	46.2	57.2	—

[a] A = College Yellow Flint
B = (A102 × A107) (A111 × A113)
C = Cuban Yellow Flint
Between entry means:
S.M.D. at 5% = 4.8 cavans per hectare
1% = 6.5 cavans per hectare
Between entry means within each date:
S.M.D. at 5% = 11.7 cavans per hectare
1% = 15.9 cavans per hectare

[b] Error Variances. Test for homogeneity of error variance: $0.70 < P < 0.80$

Based on this new analysis, the differences between the hybrid and the two varieties in the October planting were significant.

The significant interaction between date and entry was concluded to be due mainly to the varying relationship between the hybrid yields and those of the check varieties, since the hybrid consistently

[3] G. W. Snedecor, "Statistical methods," Iowa State College Press, Ames, Iowa, 1946. p. 249-252.

yielded higher than the two checks in all the six plantings included in this new analysis.

DISCUSSION AND CONCLUSION

The two experiments indicated the high specific combining ability of A107 with A111 × A113. Hybrids (A102 × A107) (A111 × A113) and (A103 × A107) (A111 × A113) were definitely superior in grain yield to College Yellow Flint. At worst, the hybrids were even slightly better than College Yellow Flint. Philippine Hybrid No. 1a was somewhat more susceptible to downy mildew than College Yellow Flint. Philippine Hybrid No. 1b and College Yellow Flint had about the same mean downy mildew infection for seven plantings. However, the grain yield increases of Philippine Hybrid 1a over College Yellow Flint were more impressive than those of Philippine Hybrid 1b.

These advanced tests showed that the continued use of these two hybrids until better ones are obtained is warranted.

* * *

Agriculture for an honorable and highminded man is the best of all occupations or arts by which men procure the means of living.

—*Xenophon*

* * *

Agriculture not only gives riches to a nation, but the only riches she can call her own.

—*Johnson*

SOLVENT-PROCESS EXTRACTED COPRA MEAL VS. EXPELLER-PROCESS EXTRACTED COPRA MEAL IN POULTRY RATIONS [1]

F. M. Fronda, T. V. Katigbak, and R. Z. Ortigas

Chicks fed rations containing levels of 9.48 and 13.57 per cent solvent-extracted copra meal gave responses in growth, efficiency in conversion of feed, and livability comparable to those that received rations containing the same level of expeller-extracted copra meal.

Layers on a ration containing 10 per cent solvent-extracted copra meal had the same rate of egg production and feed consumption as those on a ration containing the same level of expeller-extracted copra meal.

One of the cheapest and easily available feed ingredients that can be utilized for poultry feeding in the Philippines is copra meal. The use of copra meal as an ingredient in poultry rations has been studied as early as 1919, and results of these studies were very encouraging (Fronda, 1919). There are, however, certain setbacks connected with the feeding of high levels of this ingredient. Fronda and Mallonga (1935) observed that chicks which received 20 per cent copra meal in the ration attained the heaviest weight at 12 weeks of age, but had a high mortality rate. Sulit in 1936, reported that a high percentage of copra meal in the ration is toxic to chicks fed with it. De los Santos (1951) fed copra meal washed with water to chicks, and the results showed that washing did not have any beneficial effect on its feeding value.

Morrison (1951) stated that limited amounts of coconut oil meal can be included in poultry rations when sufficient better-quality protein is provided. Luna (1939) observed that a combination of five per cent copra meal and 20 per cent shrimp or fish meal, as a supplement of the ration, promoted better growth, and resulted in lower mortality of chicks than a supplement of 25 per cent of shrimp or fish meal alone. A number of other studies on copra meal reviewed by Ranit [2] (1955), apparently indicate that for best results copra meal should be used in proportions not exceeding 20 per cent of the

[1] Central Experiment Station Contribution No. 1950. Research Project No. 817.

[2] G. O. Ranit, Proceedings of Feed Manufacturers' Conference, U.P. College of Agriculture, March 12, 1955.

total ration for growing chicks. Laying chickens, however, can tolerate higher proportions of this ingredient in their diet without adverse effects on their physical condition. Crucillo (1926) stated that copra meal is valuable for laying hens when fed between limits of 20 to 30 per cent of the ration. Similarly, results of an English test showed that levels of 20 to 25 per cent copra meal in the ration gave satisfactory results as a substitute for wheat bran in the mash for laying hens (Morrison, 1951).

The copra meal used in studies conducted in the Philippines was the by-product of oil pressing machines, hence the term expeller-extracted copra meal. A shipment of several bags of solvent-extracted copra meal [3] from the United States made possible this investigation which compares the feeding value of two kinds of copra meal for poultry. The solvent-extracted copra meal is the by-product of chemical extraction of oil.

MATERIALS AND METHODS

The rations shown in table 1 were fed to replicated lots of straight run day-old Single Comb White Leghorn chicks up to 12 weeks of age. Each ration was fed to 90 chicks in three trials. Trial 1 was conducted from February 4, to April 29, 1955; trial 2, from August 30, to November 22, 1955; and trial 3, from January 24, to April 17, 1956. The levels of copra meal tested were 9.48 per cent for rations 1 and 2; and 13.57 per cent for rations 3 and 4.

TABLE 1.—*Composition of rations fed to chicks*

INGREDIENT	RATION [a]			
	1	2	3	4
Rice bran	50	50	50	50
Ground yellow corn	20	20	20	20
Soybean oil meal	15	15	15	15
Fish meal	7	7	7	7
Expeller-extracted copra meal	10	—	15	—
Solvent-extracted copra meal	—	10	—	15
Oyster shell powder	2	2	2	2
Common table salt	1	1	1	1
Aurofac	0.5	0.5	0.5	0.5
Per cent protein	19.8	19.5	20.4	20.1

[a] Cod liver oil was provided when the chicks had no access to sunlight.

[3] Supplied by Cargill Inc., San Francisco, California through former Visiting Cornell Professor J. K. Loosli.

The chicks were housed in electrically heated battery brooders until they were fully feathered, and then transferred to rearing cages that were provided with sun porches. Feed and water were supplied liberally to the chicks. Records of their bi-weekly weights, amount of feed consumption, and mortality were kept.

A ration consisting of 25 parts rice bran, 50 parts ground yellow corn, 10 parts copra meal and 15 parts fish meal plus adequate amounts of salt and shell powder was fed to two lots of 30 Single Comb White Leghorn pullets of uniform size and age. Expeller-extracted copra meal was used in lot I which served as the control, and solvent-extracted copra meal was used in lot II. The pullets were housed in shed-type laying houses located in spacious yards. The birds had access to feed and water all day. The birds in the two lots were subjected to identical care and management throughout the experiment. The monthly weights of the birds, mortality, egg production, and feed consumption were recorded. This phase of the work was conducted from September, 1955 to August, 1956.

Analysis of the two kinds of copra meal revealed that the only appreciable difference in composition between the two ingredients was in the fat and moisture contents.

NUTRIENT	EXPELLER-EXTRACTED *per cent*	SOLVENT-EXTRACTED *per cent*
Moisture	4.84	11.14
Crude protein	22.89	20.31
Crude fat	7.74	2.76
Nitrogen-free extract	49.15	47.46
Crude fiber	8.53	11.46
Ash	6.82	6.88

RESULTS AND DISCUSSION

Growing chicks. Table 2 shows that cockerels tested on rations 2, 3, and 4 were 98.2, 90.7, and 96.0 per cent as heavy as those in ration 1. In the same order, the pullets in these rations weighed 104.5, 92.7, and 96.1 per cent as much as those in ration 1. However, analysis of variance of nine individual cockerel weights, and 12 individual pullet weights selected at random from each trial of every treatment did not reveal significant differences between rations.

The efficiency in the conversion of feed, expressed in unit of feed per unit gain, and the rate of mortality of chicks in the four rations were variable, and these variations were not due to the rations.

TABLE 2.—*Performance of chicks at 12 weeks of age*

RATION	TRIAL	BODY WEIGHT AT 12 WEEKS (grams)		BODY WEIGHT INDEX		UNIT OF FEED PER UNIT GAIN [a]	PERCENTAGE OF MORTALITY
		males	*females*	*males*	*females*		
1	1	1009.8	779.0			4.38	10.0
	2	908.7	807.5			3.67	16.7
	3	956.4	802.5			3.86	0.0
	x	958.3	796.3	100.0	100.0	3.97	8.9
2	1	952.5	723.3			4.99	3.3
	2	932.7	821.5			4.48	10.0
	3	938	870.8			4.88	16.7
	x	941.3	805.1	98.2	104.5	4.78	10.0
3	1	836.1	746.3			5.26	10.0
	2	926.1	751.5			4.20	23.3
	3	841.1	716.7			4.56	6.7
	x	868.8	738.1	90.7	92.7	4.67	13.3
4	1	842.8	949.0			5.85	3.3
	2	1045.1	788.9			4.42	10.0
	3	872.2	757.5			4.07	0.0
	x	920.1	765.1	96.0	96.1	4.78	4.4

[a] Significant between trials; efficiency in feed conversion was significantly higher in trials 2 and 3 than in trial 1.

Laying chickens. A summary of the performance of the pullets for one entire laying year is shown in table 3. As may be seen, there is very little difference in the performance between the two lots. Mortality was higher in lot II only because on the eleventh month of the study, four birds that were afflicted with crop impaction were removed from the flock. This ailment, however, was not attributed to the kind of copra meal in the ration.

Lot II had a slightly higher egg production than lot I, but statistical analysis revealed no significant difference in egg production between the two lots.

TABLE 3.—*Performance of pullets*

ITEM	LOT I	LOT II
Average initial weight, kg.	1.3	1.3
Average final weight, kg.	1.3	1.4
Percentage of mortality	30.0	46.6
Average chicken-day egg production per cent	29.5	34.1
Kilograms of feed per bird per year	30.44	33.31
Kilograms of feed per dozen eggs produced	3.26	3.09

The average yearly consumption of each bird in lot I was 30.44 kg.; and in lot II, 33.31 kg. In spite of the smaller consumption of the birds in lot I, they needed 3.26 kg. of feed to produce a dozen eggs; those in lot II required 0.17 kg. less.

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There seems to be but three ways for a nation to acquire wealth: the first is by war, as the Romans did, in plundering their conquered neighbors—this is robbery; the second by commerce, which is generally cheating; the third by agriculture, the only honest way, wherein man receives a real increase of the seed thrown into the ground, in a kind of continual miracle, wrought by the hand of God in his favor, as a reward for his innocent life and his virtuous industry.

—*Franklin*

* * *

He that would look with contempt on the pursuits of the farmer, is not worthy of the name of a man.

—*H. W. Beecher*

THE BREEDING HABITS OF BERKSHIRE SWINE [1]

MODESTO G. QUINTO [2]

The most common oestral signs noted were: (a) willingness of the sow to be mounted by the boar; (b) mucous discharge from the enlarged vulva; (c) restlessness; (d) lack of appetite; (e) mounting of other sows; (f) frequent attempts to urinate with little or no discharge; and (g) constant voicing of peculiar loud grunting sounds. Initial oestrus occurred in gilts at the average age of five months and sixteen days.

The duration of oestrus averaged 3.08 ± 0.12 days; the length of oestrus cycle, 20.43 ± 0.81 days. The first oestrus after farrowing occurred 3.38 ± 0.47 days on the average; and the second oestrus after farrowing, 61.50 ± 0.59 days, or 5.50 days after the average time of weaning.

The sows at mating time manifested the following: (a) restlessness; (b) approaching of the boar; (c) frequent urination; (d) licking and smelling the boar's sheath; (e) acceptance of the boar; (f) quivering of the muscles of the ham, and simultaneous arching and stretching of the back; and (g) grunting during mating. The boars showed the following behavior: (a) persistent following and caressing of the sow; (b) licking and smelling the vulva, belly, and face of the sow immediately before services; (c) grunting before mating; (d) protrusion of the penis; and (f) muscular wave-like movement at the base of the tail around the region of the ampullae during ejaculation.

Mating lasted an average of 3.56 ± 0.12 minutes, and the interval between two matings, 13.28 ± 0.90 hours. The average number of matings in one oestrus was 5.0.

The signs of pregnancy that were generally recognized were: (a) cessation of heat periods; (b) tendency to become quiet, (c) tendency to fatten; (d) constant increase in measurement of middle girth; and (e) movement of fetuses. The signs of approaching parturition were: (a) gathering of bedding one to three days before farrowing; (b) depression at the flanks, distension of the udder and sinking of the rump one to two days before farrowing; (c) nervousness two days before farrowing; (e)

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[2] The writer wishes to thank Messrs. Francisco V. Bagaipo and Vicente Celeto for their assistance during this investigation; Mr. Lourdio L. Clamohoy for suggestions carried out in the study and Dr. V. Villegas for critical reading of the manuscript.

vaginal mucous discharge one to two days before farrowing; and (g) presence of milk in the teats a few days before farrowing.

The gestation period averaged 115.2 ± 0.44 days.

The average interval between the rupture of fetal membrane and the expulsion of the first fetus was 45.67 minutes; the interval of expulsion between fetuses, 22.08 minutes; the interval between expulsion of the last fetus and initial expulsion of the placenta, 51.33 minutes; and the interval between expulsion of the last fetus and complete expulsion of the placenta, 116.33 minutes. The length of time of farrowing averaged 5.00 hours, ranging from 3.17 to 8.33 hours.

Berkshire sows and boars which have shown adaptability to local conditions, will very likely play a significant role in the promotion of the swine industry of the Philippines. A knowledge of their breeding habits will contribute to the efficient management of this breed. This study was conducted in the Department of Animal Husbandry from June, 1955, to June, 1956, to observe the following: (a) signs, phases, duration, first appearance, and recurrence of oestrus; (b) behavior of the sow and boar during mating and frequency, interval, and duration of mating; (c) signs of pregnancy; (d) signs of approaching parturition; (e) behavior of sow and newborn pigs before, during, and immediately after farrowing; and (f) length of the gestation period.

MATERIALS AND METHODS

Materials. Nineteen gilts, one two-year-old sow, ten mature sows, one yearling boar, and two mature boars were used in this study.

Each sow and her litter were confined in a hog pen with an adjoining outdoor run. Each hog pen had concrete walls and floor, and an area of 3 square meters.

A Fairbanks-Morse portable scale of 750-kilogram capacity and a metric tape were used to weigh and measure the sows.

Feeding and management. The gilts and sows were given ration No. 1 during the nursing period, ration No. 2 during the gestation period, and ration No. 3 during the dry period. The breeding boars were given ration No. 1 when in active service. When not in use, however, they were fed with ration No. 3. Animals were fed in the morning at about eight o'clock, and in the afternoon at about four o'clock.

The rations used, all parts by weight, were as follows:

INGREDIENTS	NO. 1	NO. 2	NO. 3
Corn	10	15	20
Fine rice bran	60	60	60
Copra meal	20	18	16
Fish meal	10	7	4
Total	100	100	100
Mineral mixture	2	1.5	1

In addition, equal parts of ground shell and common salt were added to every 100 kilograms of the feed mixture. The hogs were given camote vines as soilage and allowed free access to water at all times.

A few days before farrowing, each sow was confined in a clean pen provided with either rice straw or dry cogon as bedding. On the first day after farrowing, the sows were given little or no feed. They were later gradually brought to full feeding.

The breeding boars were kept in separate pens to avoid fighting.

Observation of breeding habits. The animals were observed daily from six to seven o'clock in the morning and from four to six o'clock in the evening and at other times available.

After weaning the gilts were tested with a teaser boar once every two days to determine the age at which the first oestrus of sows occurs. Willingness of the gilts to accept the teaser boar was considered the sure sign of heat. These gilts, however, were not bred at the first occurrence of oestrus because they had not yet attained the growth and development necessary to insure successful raising of progeny.

The sow was confined with the boar in a pen one to two days before she was expected to come in heat until the end of heat, when the sow persistently refused to allow the boar to mount her. During this period, observations were made the whole day and late at night to determine the interval between consecutive matings and frequency of matings in one oestrus. To further check the presence of heat, another boar used as a teaser was kept with the sow for about thirty minutes, and then taken away after it had repeatedly attempted to mount the sow but had been rejected. The duration of mating was taken as the time between the successful insertion of the copulatory organ and its withdrawal.

The period between the time the sow first showed willingness to accept the teaser boar during the previous oestrus and the first mating during the following oestrus was taken as the interval between oestruses.

Weekly weighings and measurements of the middle girth of pregnant sows from the date of breeding were made and external changes in the animals' bodies were observed and recorded.

The behavior of each sow four to five days before farrowing, at farrowing, and immediately after farrowing was continuously observed.

After farrowing, the dam was brought to the boar daily for about six days to determine the interval between farrowing and the following oestruses. Of the ten sows used in this study, seven were bred after farrowing.

The interval between weaning and recurrence of oestrus in sows was observed and recorded. Seven sows of which two were bred were observed.

RESULTS AND DISCUSSION

Occurrence of first oestrus in gilts. First oestrus occurred earliest at three months and twelve days and latest, at seven months and fifteen days. The average age for the occurrence of first oestrus was five months and sixteen days.

Signs of oestrus. The following signs of oestrus were noted: (a) willingness of the sow to be mounted by the boar; (b) mucous discharge from the swelled or enlarged vulva; (c) restlessness; (d) capricious appetite; (e) mounting of other sows; (f) frequent attempts to urinate with little or no discharge, showing sexual perturbation; and (g) distinctive grunts emitted constantly as if calling for the mate. Frequent attempts to urinate, capricious appetite, restlessness, and swelling of the external genital organ of the sow were observed one to two days before the sow showed willingness to accept the boar. When the sow was at the height of oestrus, she was at a standstill. The height of oestrus in all the sows observed occurred two or three days from its onset.

Duration of oestrus. Oestrus ranged from 2.1 days in sows Nos. 32 and 77 to 5.1 days in sow No. 84. The average was 3.08 $\pm$ 0.12 days for the 18 sows studied. The gilts in this study had longer duration of oestrus than the mature sows. Apparently, the mature sows ovulated within a shorter period than the gilts.

Recurrence of oestrus after farrowing: Oestrus first occurred 3.83 ± 0.47 days after farrowing in the 9 sows studied. Sow No. 2103 came in heat two days after farrowing; and sows Nos. 55 and 220, six days. Seven sows which were not separated from their litters during the nursing period were bred, but none were safely settled. This result corroborates that reported by Bascos.[3] Smith [4] mentioned that sows can be bred a few days after farrowing but that few, if any, sows settle to a service at that time. He stated further that no sows ovulate immediately after farrowing.

The first oestrus after farrowing was the only heat manifested by all the sows observed during the average 56.0-day nursing period; the sows when bred at this time did not settle. To distinguish this immediate oestrus after farrowing from the second oestrus after farrowing, the author termed the former "nursing heat" or "pig heat" and the latter, "regular heat."

The second oestrus recurred 61.50 ± 0.59 days after farrowing, 5.50 days after the average time of weaning in the 7 sows studied. The range was from 58.5 to 63 days. This oestrus may be considered the regular oestrus, since the two sows that were bred at this time both conceived and the subsequent oestral cycles of the unbred sows recurred at regular intervals. This oestrus corresponds to the post-partum heat in cows which, according to Rice, Andrews, and Warwick,[5] recurs 40 to 60 days after calving. The possible explanations of the long average interval (57.67 days) between the nursing heat or pig heat and the first regular oestrus are first, that this interval may be the recovery period of the reproductive tract after farrowing; and second, that the progesterone which is produced during pregnancy may have inhibited oestrus.

The second oestrus after farrowing which recurred soon after weaning did not cause any delay in the recurrence of the second oestrus after farrowing.

Interval between consecutive oestruses. The average interval between two to three consecutive oestruses in 14 sows was 2043 ± 0.81 days, with individual averages ranging from 16 days (sow No. 42) to 27 days (sow No. 4030). Two sows, Nos. 11 and 42, were successfully bred during the second oestrus. This result is almost

[3] C. D. Bascos, *Philippine Agriculturist*, **37**, 28-35, (1952).
[4] W. W. Smith, "Milk Production," The MacMillan Co., New York, 1952, p. 616.
[5] V. A. Rice *et al.*, "Breeding Better Livestock," New York State College of Agriculture, Cornell University, New York, 1953, p. 465.

the same as that reported by Rice, Andrews, and Warwick [6] and close to those reported by Winters [7] and Bascos.[8] Smith [9] gave a range of 16 to 24 days, if sows were not bred.

The gilts and the mature sows varied in the length of oestrual cycle. The average length was 19.43 days for the gilts and 21.31 days for the mature sows.

Behavior of sows and boar. The sows manifested the following behavior at mating time: (a) restlessness; (b) approaching the boar; (c) frequent urination, with a considerable amount of urine ejected in the beginning, followed by smaller amounts; (d) licking and smelling the boar's sheath; (e) acceptance of the boar; (f) quivering of the muscles of the ham, and simultaneous arching and stretching of the back; (g) grunting of the sow during mating; and (h) partaking of the flocculent discharge from the boar's copulatory organ dropped on the floor during mating. Mounting of the boar by the sow was also observed, but was not common.

The boars' persistent following and caressing of the sows lasted from 3 to 30 minutes, or even an hour, depending on whether the sows were at the onset or at the height of oestrus when brought to the boars. At the onset of oestrus, the sows accepted the boars only after they had persistently followed and caressed the sows for a longer duration; at the height of oestrus, the sows immediately stimulated the boars to mating. The following behavior was observed in the boars: (a) licking and smelling the vulva, belly, and face of the sow immediately before services; (b) grunting before mating; (c) mounting the sow; (d) protrusion of the penis; and (e) muscular wave-like movement at the base of the tail around the region of the ampullae during ejaculation. Ejaculation of semen before mounting was observed when the sows refused to be mounted.

Duration of mating. The average duration of mating for the 52 observations made on 10 sows was 3.56 ± 0.12 minutes. The average durations of mating ranged from 3.15 minutes in sow No. 244 to 4.22 minutes in sow No. 2103. The shortest duration of mating was 2.0 minutes and the longest, 6.0 minutes.

The gilts and mature sows did not differ in the duration of mating.

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[6] *Ibid.*
[7] L. M. Winters, "Animal Breeding," John Wiley and Sons, Inc., New York, 1948, p. 404.
[8] Bascos, *op. cit.*
[9] Smith, *op. cit.*

Interval between matings. The interval between consecutive matings in the oestrus ranged from 9.95 (sow No. 55) to 18.29 hours (sow No. 54). The general average of 36 observations taken from the 9 sows studied was 13.28 ± 0.94 hours.

Frequency of mating in one oestrus. Four sows allowed four services and one allowed eight services of the boar in one oestrus. The 9 sows under observation allowed an average of 5.0 services.

Signs of pregnancy. The very reliable sign of conception was the sow's failure to come in heat at the next logical period. Other signs shown were: (a) change in disposition of the sows as evidenced by more quietness, greater appetite, and closer grazing; (b) tendency to fatten, as shown by the constant increase in body weight during the gestation period; (c) constant increase in measurement of middle girth of sows after conception; and (d) movement of fetuses.

Signs of approaching parturition. The following signs of approaching parturition were observed: (a) gathering of materials for bedding for the coming litter one to three days before farrowing; (b) hollowing of the flanks, distension of the udder and sinking of the rumps one to two days before farrowing; (c) nervousness two days before farrowing; (d) swelling of vulva six to ten days before farrowing; (e) vaginal mucous discharge one to three days before farrowing; (f) rapid respiration two or four days before farrowing; (g) presence of milk in the teats recognizable by pressing; (h) restlessness shown by lying down and getting up a few hours to two days before farrowing; and (i) sudden manifestation of motherly instinct, shown by the change in voice three to four days before farrowing.

Farrowing. Parturition began with the rupture of the fetal membrane, when the first trickling out of amniotic fluid from the vulva took place, and ended when the placenta was completely expelled. During this interval, contraction of the uterine and the abdominal muscles gradually accelerated from the beginning, causing the actual expulsion of the fetuses, and then gradually diminished towards the end of farrowing, but causing the expulsion of the placenta. The sow became increasingly restless and nervous, showing evident symptoms of pain; respiration became gradually accelerated; and the skin became hot and dry. Occasional stretching forward and kicking backward of the upper hind leg of the dam while reclining was observed throughout the period. At each motion, fluid trickled out of the vulva by the actual expulsion of the fetus. Almost all of the dams changed position by turning on the other side.

The sow seemed to be at ease after expelling a fetus. When another fetus was about to come out, the efforts of the sow to expel it became noticeable by the swaying of her body and by a pause in respiration and contraction of the uterine wall.

At expulsion, every pig was covered with a transparent fetal membrane. The stronger ones were freed from this membrane earlier than the weaker ones by their repeated struggles to get up during the rapid drying of the membrane. The membrane dried completely 20 to 30 minutes on the average after the expulsion. In some cases the pigs opened their eyes 10 to 20 minutes after birth after they had traveled a little distance from the dam. The navel cord was cut either at expulsion or 3 to 11 minutes later. After a few minutes the young instinctively looked for the mammary glands.

The average interval between the rupture of the fetal membrane and the expulsion of the first fetus was 45.67 minutes. The range was from 2 minutes (sow No. 412) to 120 minutes (sow No. 2103).

The interval of expulsion between fetuses ranged from 2 minutes to 78 minutes, with a general average of 22.08 minutes for the 9 sows observed.

The interval between expulsion of the last fetus and initial expulsion of the placenta averaged 51.33 minutes and ranged from 3 to 99 minutes, in sows Nos. 220 and 55, respectively.

The placenta was completely expelled 116.33 minutes from the expulsion of the last fetus. The range of this interval was from 51 minutes (sow No. 220) to 164 minutes (sow No. 11).

The loss in weight incident to parturition averaged 11.27 kilograms, or 6.74 per cent for the 8 sows. The range was from 4.6 kilograms (3.39 per cent) in sow No. 55 to 20.73 kilograms (20.35 per cent) in sow No. 85. The weight lost was the weight of the amniotic fluid, fetal membrane, and placenta. The initial weight of each litter averaged 7.62 kilograms and ranged from 2.6 kilograms (sow No. 55) to 13.2 kilograms (sow No. 85).

The normal presentation was either anterior or posterior. The ratio of occurrence of posterior and anterior presentations was 1:1.5. Except sow No. 81, all sows observed had normal presentations. Sow No. 81 died at farrowing due to the abnormal presentation of the fifth fetus. All the sows that had successfully farrowed ate the placenta.

Length of gestation. The gestation period averaged 115.2 ± 0.44 days for 10 sows. The range was from 112 days (sow No. 200) to 117.5 days (sow No. 11).

PALAY MARKETING PRACTICES OF FARMERS IN GAPAN AND SAN ANTONIO, NUEVA ECIJA, 1955-1956 [1]

VICENTE U. QUINTANA

The average size of farm was 3.6 hectares in Gapan and 3.9 in San Antonio; the production was 165 cavans per farm or 47 cavans per hectare in Gapan and 151 cavans per farm or 39 cavans per hectare in San Antonio.

The actual operators' share in Gapan was 89 cavans, 5 cavans more than that in San Antonio. One-fourth of the operators' share in both towns was marketed.

Storage of palay in the home was most common. One-third of the palay sold in Gapan was stored in baskets, and one-fourth of the amount sold in San Antonio was stored in gunny sacks.

Special variety was most common in Gapan and ordinary variety, in San Antonio. The common weight measurement at the time of sale was 46 kilograms. Eighty-two per cent of the sales in Gapan was handled by local buyers; in San Antonio, 70 per cent.

Most of the farmers in Gapan gave higher prices as the reason for their choice of marketing outlets. In San Antonio 29 per cent of the farmers chose their outlets because these were regular customers.

In Gapan, NARIC paid the highest price of ₱9.17 per cavan. Central merchants paid the lowest price. In San Antonio, the FaCoMa paid the highest price.

In Gapan, motor vehicles were used to transport 40 per cent of the sales, and animal-drawn vehicles, 42 per cent; in San Antonio, motor vehicles, 63 per cent, and animal-drawn vehicles, 28 per cent.

Cash on delivery was the most common method of payment.

In Gapan, the price gradually increased from ₱7.87 in December to ₱9.36 in April.

The greatest volume of palay in Gapan was sold in February and in San Antonio, in January. Generally, the price was directly correlated with the duration of storage in both towns. In the year studied, it paid to store palay up to March.

An understanding of marketing practices of palay farmers is needed as a basis for the improvement of farmers' income and for

[1] Central Experiment Station Contribution No. 1952. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, March, 1957. Prepared in the Department of Agricultural Economics under the direction of former Visiting Cornell Professor Glenn W. Hedlund and Mr. Fabian A. Tiongson.

the formulation of a sound governmental economic assistance program.

Marketing practices vary greatly from area to area and from farm to farm. These differences are due to basic factors affecting agricultural marketing, such as (1) relative distance between producing and consuming centers, (2) the seasonal production as compared with continuous demand by consumers, and (3) the many services required between the time and place the product is produced and the time and place and type of consumption.

The complex marketing services employed in moving products from the point of production to the ultimate consumers give rise to many problems.

The present investigation was undertaken in the towns of Gapan and San Antonio, Nueva Ecija, from April, 1956, to May, 1956, to study (1) the marketing practices of farmers, (2) the identity and marketing practices of various marketing agencies, (3) the possible relationships between the price paid to farmers and their marketing practices, and (4) other factors affecting farm price through personal interviews with the farmers.

THE AREAS

Gapan is about 25 kilometers south of Cabanatuan City. The neighboring towns are San Isidro, San Leonardo, Peñaranda, Nueva Ecija and San Miguel, Bulacan. The town of San Antonio is on the western part of Nueva Ecija with Jaen, Zaragosa, and Cabiao, Nueva Ecija and Concepcion, Tarlac as the neighboring towns. The combined area of the two towns is 15,590 hectares with a population of 25,719 in Gapan and 16,518 in San Antonio. Palay is the major crop in the areas and corn, sugar cane, fruits and vegetables are the minor crops.

THE FARMERS AND THE FARM

The average size of farm was 3.6 hectares in Gapan and 3.9 hectares in San Antonio. The average size in Nueva Ecija is 3.4 hectares.[2] On the average, the palay production was 165 cavans per farm and 47 cavans per hectare in Gapan and 151 cavans per farm and 39 cavans per hectare in San Antonio. The palay fields in Gapan, except those in Barrio Sta. Cruz, were irrigated; the palay fields in San Antonio were not irrigated.

[2] J. E. Velmonte, *Philippine Agriculturist* **27**, 520 (1938).

The areas surveyed had a high degree of tenancy. Ninety per cent of the operators in Gapan were tenants; this percentage was 5 per cent higher than that in San Antonio. In both areas, 5 per cent were owners, and the balance were part-owners (table 1).

TABLE 1.—*Tenure status of 200 farmers surveyed in Gapan and San Antonio, Nueva Ecija, 1955-56*

TENURE	GAPAN	SAN ANTONIO
	per cent	
Owner	5	6
Part-owner	5	9
Tenant	90	85
Total	100	100

Operators' share of palay. Many of the farmers in these towns had a share of 30-59 cavans (table 2). About one-fourth of the farmers in Gapan and San Antonio had a share of 60-89 cavans. The operators' share influenced the amount of palay to be channeled to the market by the operators. The actual share of the farmer averaged 89 cavans in Gapan, 5 cavans higher than that in San Antonio. This difference could be attributed to the higher productivity of the farms in Gapan because of the presence of an irrigation system.

In San Antonio the soil is very muddy during rainy seasons and in the dry season, the soil cracks. To have better yield, some of the farmers in San Antonio broadcast the seeds in advance to enable the seedlings to grow despite the continuous supply of water during the rainy season. Due to the unpredictableness of the weather, many

TABLE 2.—*Distribution of farmers according to operators' share*

CAVANS	GAPAN	SAN ANTONIO
	per cent	
30 and below	6	19
30–59	40	27
60–89	23	25
90–119	15	10
120–149	8	10
150 and above	8	9
Total	100	100

seedlings either rotted or dried. The total effect of this uncontrollable force of nature and of the absence of irrigation sometimes resulted in low yield.

Disposition of operators' share. In both areas surveyed, one-fourth of the operators' share was marketed (table 3). Total number of cavans stored at home in Gapan constituted 25 per cent of the operators' share, which was seven per cent higher than that in San Antonio. However, San Antonio operators allotted a greater percentage of their share to the settlement of financial obligations. The number of cavans milled also covered a big part of the operators' share. The farmers utilized their shares mainly for marketing, milling for home use, payment of debts, and storage at home. However, there was no way of determining the purpose of the palay stored at home. If this amount and that stored at ACCFA had been marketed, the sales would have been correspondingly higher.

TABLE 3.—*Disposition of operators' share of palay*

ITEM	GAPAN		SAN ANTONIO	
	cavans	*per cent*	*cavans*	*per cent*
Sold	20.4	23	20.9	25
Milled for home use	14.4	16	15.1	18
Livestock	1.6	2	1.7	2
Shrinkage	0.7	1	0.2	[a]
Stored at home	22.1	25	12.5	15
Stored at ACCFA	5.4	6	8.1	10
Debt	20.7	23	22.7	27
Bartered	0.1	[a]	0.1	[a]
Gifts	3.4	4	2.3	3
Average and total	88.8	100	83.6	100

[a] Less than one per cent.

Farm practices. Before palay could be marketed, stored, milled, or used for payment of debt, the farmers had to perform numerous processes. Palay with the straw was generally bundled and dried for three or four days in the field before it was threshed. For convenience in drying, the palay was piled in *sipok*. These *sipoks* were repiled into a *mandala* before being threshed.

Ninety-eight per cent of the operators in Gapan threshed their palay by a threshing machine or *trilladora*. The rest did the threshing by feet (table 4. In San Antonio, 91 per cent employed *trilla-*

doras. Threshing and cleaning of palay were simultaneously done by the machine. Palay threshed by feet was cleaned with the use of hand winnowers.

TABLE 4.—*Pre-sale practices of farmers*

METHOD	GAPAN	SAN ANTONIO
	per cent	
Drying:		
On straw in field	100	90
On straw in residence	—	7
After threshing	—	3
Total	100	100
Threshing:		
Threshing machine	98	91
By feet	2	9
Total	100	100
Cleaning:		
Hand winnowing	2	9
Inclusive with machine	98	91
Total	100	100

STORAGE

Place of storage. Twenty-seven per cent of Gapan farmers and 40 per cent of San Antonio farmers did not store their palay. The other farmers stored palay in the house, bodegas, and other storage places.

Storage of palay at home was practised by about 45 per cent of the farmers in Gapan and San Antonio. In Gapan, 17 per cent of the farmers stored their palay in bodegas, whereas in San Antonio only 8 per cent (table 5).

TABLE 5.—*Place of storage of palay*

PLACE OF STORAGE	GAPAN	SAN ANTONIO
	per cent of farmers	
No storing	27	40
In the house	44	45
Bodega or granary	17	8
Others	12	7
Total	100	100

Type of storage containers. In Gapan, more than one-third of the palay sold was stored in baskets; in San Antonio, nearly one-fifth (table 6). One-fourth of the amount sold in San Antonio was stored in gunny sacks. In Gapan, it was less than one-fifth. Twenty-six per cent of the palay in San Antonio was not stored as compared with 9 per cent in Gapan. Palay was also stored loose and some palay was placed in boxes, *garong,* and bins. Some farmers preferred to use baskets to store palay for a longer period of time. However, others used gunny sacks because of the ease in using these for immediate sale.

TABLE 6.—*Type of storage containers used for palay*

STORAGE CONTAINER	GAPAN		SAN ANTONIO	
	cavans	*per cent*	*cavans*	*per cent*
No storing	188	9	536	26
Gunny sacks	378	18	518	25
Baskets	685	34	384	18
Loosely stored	215	11	386	18
Others	569	28	265	13
Total	2035	100	2089	100

PALAY SALES

Sales made by farm operators. About half of the Gapan farmers and two-thirds of the San Antonio farmers disposed of their palay in a single transaction. On the other hand, two-fifths of the farmers in Gapan and one-fourth in San Antonio made two or three sales. Others made four to eight sales before totally disposing of their palay. In Gapan the maximum number of sales was five, whereas in San Antonio it was eight. More than two or three sales were usually made by farmers with large production (table 7).

Sales by variety. In Gapan, more than four-fifths of the palay sold was of the special variety,[3] and almost one-fifth, of the ordinary variety (table 8). In San Antonio, however, almost all the palay was of the ordinary variety.

The nature of farming, especially the physical factors, determines the variety to be planted. In San Antonio, special varieties were not commonly planted because of the absence of an irrigation system.

[3] Classification was based on the eating quality and size and shape of kernel.

TABLE 7.—*Sales by tenure status*

NUMBER OF SALES	Owner	Part-owner	Tenant	All Operators	Owner	Part-owner	Tenant	All Operators
		per cent				*per cent*		
1	1	3	45	49	5	7	55	67
2	2	—	19	21	—	—	16	16
3	1	1	17	19	—	—	7	7
4	1	—	6	7	1	1	3	5
5	—	1	3	4	—	1	2	3
6	—	—	—	—	—	—	1	1
8	—	—	—	—	—	—	1	1
Total	5	5	90	100	6	9	85	100

TABLE 8.—*Variety of palay sold*

VARIETY	GAPAN		SAN ANTONIO	
	cavans	*per cent*	*cavans*	*per cent*
Fancy [a]	15	1	—	—
Special [b]	1665	82	56	3
Ordinary [c]	355	17	2033	97
Total	2035	100	2089	100

[a] Milagrosa, milflor, wagwag.
[b] Apostol, Benzer, Burma, Consejala, Elon-elon, Kinanda, Los Baños, Raminad, Seraup Kechil, 12-36.
[c] Azucena, Bino, Cariñosa, Cobos, Dinalaga, Kumpol, Lamyo, Macan Puti, Macan Sta. Rosa, Macan Toyo, Ramai Paaga, San Felipe, Squad.

Average weight of palay. Palay was sold by the cavan, but the weight per cavan varied. Seventy-nine per cent of the sales in Gapan and 69 per cent in San Antonio were made on the basis of 46 kilograms per cavan (table 9). However, some of the sales were made on a 45-kilogram basis. In some instances, farmers sold their palay

TABLE 9.—*Average weight per cavan of palay*

WEIGHT IN KILOS	GAPAN	SAN ANTONIO
	per cent of sales	
44	—	5
45	16	19
46	80	70
47	4	3
48	—	3
Total	100	100

on 47- and 48-kilogram-per-cavan bases. These instances, however, constituted a small percentage of the sales, and occurred only during the harvest months.

In San Antonio more farmers sold their palay at less than 46 kilograms per cavan than in San Antonio.

In instances where sales were made on the basis of more than 44 kilograms per cavan, the NARIC standard weight, the farmers reasoned that the excess weight was to allow for shrinkage.

BUYERS

Type of outlets. The local buyers were the most important outlets for palay in the areas surveyed. Eighty-two per cent of the sales transacted in Gapan were made by the local buyers, and in San Antonio, 70 per cent (table 10). The NARIC played a minor role as a market outlet for the farmers' produce. This governmental agency bought palay only at the time of harvest to establish a floor price. In San Antonio, the NARIC Station was open only during the harvest season, whereas in Gapan it was open the whole year. But even in Gapan the NARIC did not do much purchasing and it hardly did any in San Antonio. Out of the 200 farmers surveyed, only 11 sold their palay to the local FaCoMa during the "lean months." The direct sales to FaCoMas were less than the deposit sales. Deposit sales were made after the palay had been stored and when the prices were reasonably high.

TABLE 10.—*Type of buyers chosen by farmers*

TYPE OF BUYER	GAPAN		SAN ANTONIO	
	Per cent of sales	Per cent of volume	Per cent of sales	Per cent of volume
Local rice mills	1	4	7	7
Local buyers	82	80	70	60
Local stores	2	[a]	3	1
FaCoMa, direct sale	1	2	2	4
FaCoMa, deposit sale	3	6	5	9
NARIC	2	1	1	1
Central merchant [b]	1	[a]	2	8
Landlord	4	4	1	[a]
Others	4	3	10	10
Total	100	100	100	100

[a] Less than one per cent.
[b] Merchants from the poblacion.

The local rice mills, local stores, central merchants, and landlords were minor types of outlet. The percentage for total volume purchased by local buyers was relatively less than that for the number of sales.

Reasons for choosing outlets. The farmers interviewed had various reasons for their choice of buyers. The major reason given by Gapan farmers was the higher price offered by the buyers. In San Antonio, the major reason was that the buyers were regular customers of the farmers (table 11). A fair number of farmers, however, chose their buyers because of the convenience offered by the latter in seeking out the palay. Other less important reasons included credit, relations, and honesty.

TABLE 11.—*Reasons for choosing outlet*

REASON	GAPAN	SAN ANTONIO
	per cent	
Higher price	31	13
Regular buyer	9	29
Friends and relatives	6	7
Credit	9	7
Only buyer	4	5
Nearness, convenience	9	15
Buyer sought out palay	15	16
Honesty	6	6
Others	11	2
Total	100	100

Size of sale. The size of sale made by farmers varied widely with type of buyers, and even from town to town. The average sale of 13 cavans in San Antonio was three cavans higher than that in Gapan (table 12).

Although the local buyer was the most common outlet in both areas, the volume of sales was only about one-fourth that of local rice mills in Gapan and the central merchants in San Antonio. The average sale to local buyers in Gapan was 10 cavans, and in San Antonio, 11. In both areas, the average FaCoMa purchase was twice as large as the purchases of local buyers.

The NARIC, a buying agency of the government, was not popular among farmers in either area. It made only three purchases in Gapan and one in San Antonio, with less than 10 cavans each.

The local store was the smallest outlet in terms of size per sale. These small sales were frequently made to meet the immediate needs of the farmer for cash.

TABLE 12.—*Size per sale by type of buyer*

TYPE OF BUYER	GAPAN	SAN ANTONIO
	cavans per sale	
Local rice mills	37.5	13.0
Local buyers	10.1	11.1
Local stores	2.0	5.0
FaCoMa, direct sale	21.0	19.2
FaCoMa, deposit sale	18.0	23.2
NARIC	6.0	8.0
Central merchant	6.0	43.2
Landlord	10.0	—
Others	7.4	13.5
Average	10.1	13.0

Prices paid. Among the different types of buyers in Gapan, NARIC paid the highest price of ₱9.17 a cavan. However, unclassified buyers paid as much as ₱9.22 a cavan. The local stores paid ₱9.12 a cavan, whereas the landlord, basing the value on the existing market price, paid ₱9.11 a cavan. The FaCoMa returned ₱8.75 for direct sale and ₱8.68 for deposit sale.

In San Antonio, the FaCoMa paid the highest price of ₱8.59 a cavan for direct sale and ₱8.55 for deposit sale. The NARIC paid only ₱8.00 a cavan. The local stores, however, paid ₱8.46.

Considering these price data it is hard to conclude that one price is better than the others. Various factors, such as time of sale and variety, have to be considered. Time element has a great influence in price determination. High price may be attributed to the fact that purchase was made during the months of scarcity of palay, or perhaps, purchase was made only of fancy and special varieties. The type of buyers also influenced the price.

TRANSPORTATION

Method of transportation. In both municipalities surveyed, various types of vehicles were used to transport palay from the farms to the initial market. Motor vehicles accounted for 63 per cent of the total sales in San Antonio and only 40 per cent in Gapan. The

TABLE 13.—*Average price per cavan paid by different types of buyers*

TYPE OF BUYER	GAPAN			
	Fancy	Special	Ordinary	All varieties
		pesos		
Local rice mills	—	9.80	7.90	8.85
Local buyers	9.40	8.87	8.67	8.84
Local stores	—	9.10	9.20	9.12
FaCoMa, direct sale	—	8.75	—	8.75
FaCoMa, deposit sale	—	8.56	9.30	8.68
NARIC	—	9.25	9.00	9.17
Central merchants	—	8.20	—	8.20
Landlord [a]	9.85	9.01	—	9.11
Others	—	9.22	—	9.22
Average	9.49	8.89	8.69	8.86
	SAN ANTONIO			
		pesos		
Local rice mills	—	8.30	8.08	8.12
Local buyers	—	8.32	8.12	8.13
Local stores	—	—	8.46	8.46
FaCoMa, direct sale	—	—	8.59	8.59
FaCoMa, deposit sale	—	—	8.55	8.55
NARIC	—	—	8.00	8.00
Central merchants	—	—	8.15	8.15
Landlords [a]	—	—	—	—
Others	—	—	8.43	8.43
Average	—	8.32	8.20	8.20

[a] Price was based on existing market price.

difference could be attributed to the greater distance from farm to market in San Antonio.

Animal-drawn vehicles were commonly used in Gapan. This type accounted for 42 per cent of the total sales in Gapan and 28 per cent in San Antonio. Farms in Gapan are closer to the market. Other sales were transported partly by motor vehicles and partly by animal-drawn vehicles and other forms of transportation.

Of the 2,089 cavans sold in San Antonio, three-fourths were transported by motor vehicles and one-fourth by animal-drawn vehicles. Of the 2,035 cavans sold in Gapan, 45 per cent were transported by motor vehicles and 39 per cent by animal-drawn vehicles (table 14). Generally, the shorter the distance from the farm to the market, the greater was the use of animal-drawn vehicles.

TABLE 14.—*Methods of transporting palay from farm to buyer*

METHOD OF TRANSPORTATION	GAPAN		SAN ANTONIO	
	Number of sales	Cavans	Number of sales	Cavans
	per cent		*per cent*	
Animal-drawn vehicle	42	39	28	19
Motor vehicle only	40	45	63	76
Animal and motor	10	8	4	3
Others	8	8	5	2

Cost of hired transportation. The cost of hired transportation had a direct relationship with distance. As distance increased, the cost of transportation increased. Generally, the cost of transportation per unit distance was relatively equal in both areas. In transporting a cavan of palay in both towns, a distance of two to five kilometers cost about ₱0.13; a distance of six to eight kilometers, around ₱0.19. In Gapan, it cost a farmer ₱0.34 to transport his palay a distance between nine to eleven kilometers. However, there were very few farmers that paid this amount. On the other hand, in San Antonio, it cost a farmer from ₱0.19 to ₱0.27 to transport his palay a distance of nine to fifteen or more kilometers (table 15).

TABLE 15.—*Cost of hired transportation by distance*

DISTANCE IN KILOMETERS	GAPAN	SAN ANTONIO
	pesos per cavan	
2 and below	0.12	0.10
3–5	0.13	0.14
6–8	0.20	0.18
9–11	0.34 [a]	0.19
12–14	—	0.24
15 and above	—	0.27

[a] Three observations.

In transporting palay from the production area to the market area it cost more to hire motor vehicles than animal-drawn vehicles. In the two towns surveyed, the farmers paid about ₱0.17 a cavan to deliver palay by motor vehicles (table 16). By animal-drawn vehicles, it cost around ₱0.15. This difference in cost might be caused by home factors other than the type of transportation. This include distance and road conditions.

TABLE 16.—*Cost of hired transportation by method*

METHOD OF TRANSPORTATION	GAPAN	SAN ANTONIO
	pesos per cavan	
Animal-drawn vehicles	0.13	0.15
Motor vehicle	0.17	0.18
Others	0.19	0.10
Average	0.15	0.17

METHOD OF PAYMENT

Cash on delivery was the most frequent method of payment. This method accounted for about two-thirds of the volume of sales in both municipalities. The other one-third was either paid for in advance, or in installment, or paid after delivery (table 17). Of the total volume sold, 68 per cent was paid in cash in Gapan; 67 per cent in San Antonio.

TABLE 17.—*Volume and number of sales by method of payment*

METHOD OF PAYMENT	GAPAN		SAN ANTONIO	
	Sales	Cavans	Sales	Cavans
	per cent		*per cent*	
Cash on delivery	78	68	80	67
Paid in advance	9	16	9	17
Others	13	16	11	16
Total	100	100	100	100

MONTH OF SALE

In Gapan, the rate of palay disposal was relatively equal from January to April. In December, it was very low (table 18). The farmers were not enthusiastic to sell their palay after harvest. They waited for higher prices.

In San Antonio, a somewhat greater portion of the total palay sold was unloaded to the market in December and January. A relatively larger number of farmers disposed of their palay soon after harvest. However, most of the farmers also stored their palay to get higher prices.

PRICES

Monthly price. Palay was harvested in December and January. The December price was the lowest of all the monthly prices. In

TABLE 18.—*Month of sale*

MONTH OF SALE	GAPAN			
	Fancy	Special	Ordinary	All varieties
	per cent of volume sold by months			
December	—	2	1	2
January	13	25	20	24
February	13	25	34	27
March	47	25	19	24
April	27	23	27	23
	SAN ANTONIO			
	per cent of volume sold by months			
December	—	—	7	7
January	—	18	31	30
February	—	14	22	22
March	—	14	21	21
April	—	14	21	21

Gapan, the price gradually increased from ₱7.87 in December to ₱9.86 in April. The difference between the December price and the April price was ₱1.49. In San Antonio, there was also a gradual increase of the price. The difference between the December price and the April price was ₱1.41 (table 19).

TABLE 19.—*Average monthly price per cavan of each variety*

MONTH OF SALES	GAPAN			
	Fancy	Special	Ordinary	All varieties
	pesos			
December	—	7.88	7.80	7.87
January	9.00	8.48	8.10	8.41
February	9.00	8.81	8.96	8.74
March	9.48	9.25	8.97	9.21
April	10.50	9.28	9.42	9.36
Average	9.49	8.89	8.69	8.86
	SAN ANTONIO			
	pesos			
December	—	—	7.42	7.42
January	—	7.58	7.86	7.85
February	—	8.53	8.32	8.33
March	—	8.90	8.65	8.66
April	—	8.80	8.83	8.83
Average	—	8.32	8.20	8.20

The average price of all varieties in Gapan was higher by ₱0.66 than in San Antonio. This was partly due to the higher proportion of fancy and special varieties in the sales. The highest-priced palay in Gapan was a fancy variety which sold ₱9.49 per cavan. The ordinary variety was ₱0.80 less and the special variety ₱0.60 less than the fancy variety. Fancy varieties were not grown in San Antonio. The price of special variety was ₱8.32, higher by ₱0.11 than that of ordinary variety.

The farmers stored palay either for consumption or for future sale. The purpose of storage for future sale was to get a higher price. In both towns, storing palay when supply was great (December to March) had a direct relation to the price received; the longer the palay was stored the higher the price (table 20).

TABLE 20.—*Average price per cavan of each variety by duration of storage*

DURATION OF STORAGE IN MONTHS	GAPAN			
	Fancy	Special	Ordinary	All varieties
		pesos		
None	9.00	8.53	7.89	8.43
0.25 and below	—	8.43	8.39	8.41
0.26–0.75	—	8.63	8.21	8.53
0.76–1.5	9.00	8.89	8.67	8.85
1.51–3.5	9.48	9.14	8.96	9.14
2.51–3.5	10.58	9.58	9.29	9.51
3.51–up	—	8.69	9.52	8.84
Average	9.49	8.89	8.69	8.86
	SAN ANTONIO			
		pesos		
None	—	7.70	7.79	7.78
0.25 and below	—	7.45	7.95	7.93
0.26–0.75	—	8.52	7.80	7.80
0.76–1.5	—	—	8.28	8.30
1.51–3.5	—	—	8.64	8.64
2.51–3.5	—	—	8.69	8.69
3.51–up	—	8.85	8.86	8.86
Average	—	8.32	8.20	8.20

Comparison of Cabanatuan wholesale price and farm price of ordinary palay. The comparison was made to determine the marketing margins in the two towns. The difference was attributed to the cost of marketing plus profit. The wholesale prise used, except that of

December which was 1955 price, was the 1956 price. The price differential in December was ₱0.64 in Gapan and ₱1.02 in San Antonio (table 21).

The large price differentials in both towns were due to the fact that the December wholesale price was applied to both old and new crops, whereas the corresponding prices at the farm were for the new crop.

The differentials from month to month gradually decreased, except in January. The negative differentials in Gapan and small differentials in San Antonio in January were due to the presence of many local buyers who were either local agents or direct consumers.

TABLE 21.—*Comparison of Cabanatuan price and farm price of ordinary palay*

MONTH	Cabanatuan wholesale price [a]	Farm price	Price differential
	GAPAN		
		pesos	
December	8.44	7.80	+0.64
January	7.87	8.10	—0.23
February	8.52	8.46	+0.06
March	8.98	8.97	+0.01
April	9.10	9.42	—0.32
		SAN ANTONIO	
December	8.44	7.42	+1.02
January	7.87	7.86	+0.01
February	8.52	8.32	+0.20
March	8.98	8.65	+0.33
April	9.10	8.83	+0.27

[a] Based on Bureau of Commerce 1956 average monthly price of palay *ordinario* in Cabanatuan City—per sack of 44 kilograms.

Potential gain from storage. If farmers store palay, their main objective is to wait for a price that will give them the best returns possible. Storage may or may not be profitable at all. In table 22, assumptions were made in order to determine the gains or losses from storage. The potential gains determined were from storage. The potential gains determined were from December to each succeeding month up to April, from June to each succeeding month, etc. The storage fee was assumed to be ₱0.10 per cavan for every month; thus for one month the fee was ₱0.10, for two months, ₱0.20, etc. The assumed rate of interest was one per cent of the price per month. The potential gain or loss was obtained by subtracting the sum of the

storage fee, interest, and the price at the start of storing from the price in each succeeding month. Calculations were made for the special variety in Gapan and for the ordinary variety in San Antonio. These varieties were chosen because they were the most frequently stored varieties in the two municipalities.

In both towns, it was most profitable to store up to March. In Gapan, the potential gain became a loss when palay was stored from March to April. It was shown that the price gradually increased up to April but the difference between the March price and April price was not enough to pay storage costs.

Based on data for the 1955-56 year, it paid to store palay from December and succeeding months up to March in both Gapan and San Antonio. Storing from March to April resulted in a loss in Gapan and only partly paid for the expenses of storage in San Antonio. The extent of gains from storage in other years should be considered prior to engaging in extensive storage operations.

TABLE 22.—*Potential gain from storing palay*

MONTH	GAPAN			
	December	January	February	March
			pesos	
January	0.42	—	—	—
February	0.57	0.15	—	—
March	0.80	0.40	0.25	—
April	0.68	0.25	0.09	—0.16
		SAN ANTONIO		
			pesos	
January	0.27	—	—	—
February	0.55	0.28	—	—
March	0.71	0.43	0.15	—
April	0.71	0.43	0.15	—0.01

* * *

The farther we get away from the land, the greater our insecurity.

—*Henry Ford*

THE EXPENDITURES OF INCOMES OF 100 FAMILIES IN CANLALAY, BIÑAN, LAGUNA, 1955 [1]

GLORIA R. VEGA [2]

Non-farm families received higher incomes and spent more than farm families. An average of ₱1,391 for non-farm and ₱783 for farm was available for disposal by these families. The lowest income group of both families received the highest proportion of income in kind and lowest proportion of disposable income. The biggest expense item for both groups of families was food which constituted almost one-half of the total expenditures. The lower the income the higher the percentage available for clothing, advancement and personal expenses.

Clothing and personal item expenditures increased in relative importance as expenditure groups as income increased. Health and medical care showed a reverse trend. Expenditures for advancement showed no relation to income.

Higher income farmers and non-farmers had larger holdings of land and lived in better houses than those with low incomes. Household conveniences and recreational activities were not necessarily related to income.

Public authorities, private organizations and socially conscious individuals are becoming increasingly interested in or concerned with social conditions. With this growing concern, knowledge as to how families dispose of their incomes is important since family welfare depends upon how its income is used. Information is needed on the way people spend their incomes, on how much is available for the necessities of life and how much, if any, is available for comforts and luxuries.

Meager information is available in the Philippines on expenditure patterns of families for particular items of consumption. Rivera [3] in her survey of 100 rural families in Dayap, Calauan, Laguna in 1954 found that the percentage outlay for food was almost

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[1] Central Experiment Station Contribution No. 1953. Thesis submitted to the Graduate School, Cornell University, June, 1957, for the M.S. degree.

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[3] L. Rivera, *Philippine Agriculturist* **39**, 5 (1955).

one-half of the total available for family living; but there was a decrease in the proportion which went for food with an increase in income level for both farm and non-farm families. These findings agree with Engel's. As cited by Kryk [4] Ernst Engel in his "Die Productions —und Consumptionsverhaltnisse des Konigreichs Sachsen," published in 1857 made this generalization concerning family expenditures: "The poorer the family, the greater the proportion of the total expenditures which must be devoted to the provision of food. With greater well-being there is joined not merely a better material existence, but also an improved intellectual and moral life."

Hunter and Bottom [5] stated that clothing was one of the four classifications of expenditures which increased consistently with increased income for farm as well as for city families.

Expenditures of nine families over a period of years studied by Deacon [6] showed that food expenditures for farm families were less likely to follow the direction of the income change than those for salaried families.

The purpose of this study was to learn how Filipino families spend their incomes. Data on expenditures of family incomes were obtained by personal interviews in Canlalay, Biñan, Laguna. All households [7] were visited by the author during the summer of 1955 and 100 families were interviewed. The household surveyed were selected by random stratified sampling. Comparisons were made of farm and non-farm families from the standpoint of the use of income and selected social factors.

THE AREA

Canlalay, the sixth largest barrio of Biñan, Laguna province, has a population of 1,794. It lies on a lowland plain region, almost surrounded by rice fields. The fertile soil is well suited for agricultural purposes. Canlalay is 36 kilometers south of Manila.

GENERAL ECONOMIC CONDITIONS

The chief means of livelihood is farming. Rice, the main crop, is harvested twice a year. After the planting season, many farmers

[4] H. Kryk, "Economic Problems of the Family," Harper and Brothers, New York, 1933, pp. 332-333.

[5] S. M. Hunter and J. C. Bottom, *Indiana Agric. Sta. Bull.*, 3, 588 (1953).

[6] R. E. Deacon, "A Study of the Expenditures of Nine Families over a period of years" (Unpublished).

[7] A "household" was defined as the occupants of a dwelling unit or any group of persons living together with common housekeeping arrangements.

engage in other occupations such as driving *calesa* and selling in the market or along the highway. Other major sources of employment are home industries such as manufacture of slippers, wooden shoes, hats, caps, and leather shoes. Each barrio in the town has specialized in a certain type of industry. Canlalay for example, is noted for making special "pinipig." Pinipig is made out of a type of rice called "malagkit." It is soaked in water for about one to one-and-a-half days. It is dried and then half-roasted, after which it is pounded in a mortar with a pestle. There is no modern equipment or machinery used. A ganta of pinipig costs ₱2.50.

THE HOUSEHOLDS

The 100 households studied include both farm and non-farm families. Fifty-one per cent belonged to farm families and forty-nine per cent to non-farm families.

The non-farm family average income exceeded that of farm families. Sixteen per cent of the non-farm families belonged to the top income class of ₱2000 and above; there were only eight per cent of farm families in that bracket (table 1).

TABLE 1.—*Number of farm and non-farm families by income class, 100 families, Canlalay, Bíñan, Laguna, 1955*

INCOME CLASS	FARM		NON-FARM	
	Number	Per cent	Number	Per cent
2,000–above	4	8	8	16
1,500–1,999	9	18	9	18
1,000–1,499	8	16	14	29
500– 999	18	35	11	23
Below 500	12	23	7	14
Total	51	100	49	100

No relationship existed between income and number of children and members of the household. Farm families tended to be larger than non-farm families. The average size was 7.5 for farm families and 6.3 for non-farm families (table 2). For both farm and non-farm families the medium-income families were larger than low- and high-income families.

The age of heads of farm and non-farm families ranged from 22 to 73 years. Non-farmers were somewhat younger than the farmers. The average age for the farmers was 46 years (table 3). For non-farmers, it was 42 years. There was no relationship of income

TABLE 2.—*Number of children and members of the household per family*

INCOME CLASS	FARM		NON-FARM	
	Children	Total members of household	Children	Total members of household
		Average number		
2,000–above	2	6.5	3	6.3
1,500–1,999	6	9.8	5	7.0
1,000–1,499	5	8.1	3	6.4
500– 999	5	8.8	4	7.6
Below 500	3	5.5	3	5.3
Average	4.3	7.5	3 5	6.3

to age among the heads of non-farm families. Among the farmers age increased as income increased. This can partly be explained by the tendency of young heads of families to be attracted to higher paying industries like manufacturing slippers, wooden shoes, hats, caps, and leather shoes. Furthermore, farmers tend to cling to their land as evidenced by reported plans to concentrate the land in the hands of older established tenants. This would tend to discourage young folks from farming.

TABLE 3.—*Age of family heads*

INCOME CLASS	FARM	NON-FARM
2,000–above	53	47
1,500–1,999	48	36
1,000–1,499	45	48
500– 999	45	38
Below 500	45	38
Average	46	42

On the average farm family heads received less education than non-farm family heads (table 4). This may in part be related to

TABLE 4.—*Educational attainment of head of family*

INCOME CLASS	AVERAGE NUMBER OF YEARS IN SCHOOL	
	Farm	Non-farm
2,000–above	3.0	2.6
1,500–1,999	2.8	7.1
1,000–1,499	3.8	3.4
500– 999	1.9	3.8
Below 500	1.1	1.1
Average	2.2	3.7

the older age of the farmers and their having had less opportunity to attend school when they were young. Income was not related to the education of either the farm or non-farm heads except that the lowest income group reported the lowest educational attainment.

The number of hectares operated was an important factor in determining farm family income. As the income increased, the number of hectares operated increased, except for the highest income group. The exception of the highest group can be explained by the fact that in that group was a man engaged in the poultry business who was able to make a good income from a limited hectarage. The average size for all farms was 3 hectares (table 5). This is close to the average for the whole Philippines, which is 3.49 hectares.[8]

TABLE 5.—*Number of hectares operated*

INCOME CLASS	AVERAGE NUMBER OF HECTARES
2,000–above	2.4
1,500–1,999	3.4
1,000–1,499	3.1
500– 999	2.9
Below 500	2.8
Average	3.0

The houses of the families studied were almost evenly distributed as to the kind of building material used. Thirty-eight per cent of both farm and non-farm families had houses made of mixed materials, such as nipa for roofs, bamboo for floors, and either wood or nipa for walls. Twenty-eight per cent of both groups of families had houses made of strong materials; these had galvanized iron roofs, wooden floors and walls, and were large enough for the members of the family. Houses not fitting into these types mentioned and which comprised 34 per cent were considered made of light materials.

Houses made of light materials belonged mostly to the low-income groups, while the houses made of mixed and strong materials belonged to the families with high incomes (table 6).

In the over-all picture, non-farm families had more home conveniences. Flat irons and electricity were more common in farm family homes than in those of non-farm families (table 7). No relation to income was found.

[8] Statistical Handbook of the Philippines, 1953.

TABLE 6.—*Types of dwellings*

INCOME CLASS	FARM			NON-FARM		
	Strong materials	Mixed materials	Light materials	Strong materials	Mixed materials	Light materials
2,000–above	1	3	–	3	4	1
1,500–1,999	5	4	–	5	3	1
1,000–1,499	3	2	3	2	7	5
500– 999	2	7	7	3	2	6
Below 500	2	3	7	2	1	4

TABLE 7.—*Families having household conveniences*

CONVENIENCE	FARM		NON-FARM	
	Number	Per cent	Number	Per cent
Sewing machine	14	27	16	33
Kerosene stove	1	2	3	6
Flat iron	27	53	24	49
Wooden chairs	37	73	39	80
Dining table	10	20	26	53
Radio	20	39	21	43
Bed	10	20	17	35
Electricity	48	94	42	86

A higher proportion of farm families reported recreational activities compared to the non-farm families. Over half of the heads of farm families reported attending fiestas as a recreational activity compared with only 14 per cent of non-farm families (table 8). On the other hand, forty-three per cent of non-farm families reported going to movies. No relation to income was found.

TABLE 8.—*Common recreational activities of family heads*

RECREATION	FARM		NON-FARM	
	Number	Per cent	Number	Per cent
Movies	22	43	28	57
Gambling	15	29	7	14
Cockfighting	16	31	8	16
Attending fiestas	27	53	7	14

Also, no relation between organizational membership of head of family and income was observed. Parent-Teacher's Association was the most frequently reported organization.

INCOME

Forty per cent of the income of farm families came from farm produce (table 9). About two-thirds of this was consumed and the rest sold for cash. This was supplemented by making *pinipig*, shoes and other home industries and by off-farm work. Non-farm family workers usually worked either as laborers or office employees in Biñan or elsewhere.

TABLE 9.—*Source of income*

SOURCE	FARM		NON-FARM	
	Pesos	Per cent	Pesos	Per cent
Crop sales	126	12	7	0.6
Livestock sales	32	3	4	0.4
Income from other investment and/or small business profits	303	29	384	26
Salary and wage	309	30	969	67
Others	13	1	28	2
Income in kind	265	25	59	4
Total	1,048	100	1,451	100

The average disposable income (cash income minus farm and store expenses) of farm families amounted to ₱783 (table 10). This was supplemented by income in kind (farm home-furnished supplies) valued at ₱265. The disposable income of non-farm families

TABLE 10.—*Disposable income and income in kind*

INCOME CLASS	DISPOSABLE INCOME		INCOME IN KIND		INCOME TOTAL (pesos)
	Pesos	Per cent of total	Pesos	Per cent of total	
Farm					
2,000–above	[a]	—	[a]	—	[a]
1,500–1,999	1,302	76	413	24	1,715
1,000–1,499	846	71	346	29	1,192
500– 999	560	72	213	28	773
Below 500	195	56	151	44	346
Average	783		265		1,048
Non-farm					
2,000–above	2,725	96	105	4	2,830
1,500–1,999	1,747	97	61	3	1,808
1,000–1,499	1,346	98	29	2	1,375
500– 999	855	96	38	4	893
Below 500	344	78	99	22	443
Average	1,391		59		1,451

[a] Too few to average.

averaged ₱1,391 and was supplemented by income in kind amounting to ₱59. The value of the produce consumed did not include cost of cooking.

For both farm and non-farm families the lowest income groups received the highest proportion of total income in kind. In absolute terms, there was a decrease in disposable income as income decreased, but there was no related change in income in kind.

Farmers reported more borrowings than non-farmers in all income groups. One hundred per cent of farm families below the income group of ₱1,500 borrowed money (table 11). Above this income group, the number of those who borrowed decreased. There was no relationship between income and the number of those who borrowed money among non-farm families, except that the high income group did the least borrowing. Ninety-two per cent of farm families and 59 per cent of non-farm families borrowed money.

TABLE 11.—*Families who borrowed money*

INCOME CLASS	FARM		NON-FARM	
	Number who borrowed	Per cent	Number who borrowed	Per cent
2,000–above	2	50	1	13
1,500–1,999	8	89	6	67
1,000–1,499	8	100	10	71
500– 999	17	100	7	64
Below 500	12	100	5	71

EXPENDITURES

For purposes of this study, the expenditures were divided into five groups. These were food, clothing, household supplies, health and medical care, advancement and personal.

Food. All kinds of food expenditures were classified under this category, including refreshments, such as drinks and beverages, cookies, and candies.

Clothing. Classified under this heading were clothing, footwear and headwear. Jewelry and other accessories were not charged to clothing expenses.

Household supplies. This category included all articles consumed during use, like firewood and candles, as well as those for continued use such as furnishings and equipment. Laundry and ex-

penditures for household operation including payment for household help were classified under this grouping, too.

Health and medical care. Medicine and other items for health belong to this category, including hospitalization, doctors' and dental fees. Sunglasses, toothbrushes, toilet articles, and related items were not included.

Advancement. This included educational and recreational expenses. Tuition and matriculation fees, books, magazines, hobbies and other school expenses were classified under advancement expense.

Personal. Articles for personal and individual use such as cosmetics, toilet articles, jewelry and cigarettes were classified under this category. Gifts and other charitable contributions were also included.

Classification of items of expenditures

Food	*Household supplies*
Rice and other grains	Firewood
Coconut	Mats, pillows, etc.
Livestock and livestock products	Electric energy
Fruits	Candles, matches
Vegetables	Equipment
Sugar	Furnishings
Salt	Domestic help
Drinks	Laundry
Biscuits	Soap
Cookies	Water
Clothing	*Advancement*
Clothes	Tuition and matriculation fees
Headwear	Books and other reading material
Footwear	
Health and medical care	*Advancement*
Medicine	School supplies
Hospitalization	School allowance for children
Doctors' fees	Hobbies
Dental fees	Dances
General medical care	Athletics
	Movies

Personal
Cosmetics and toilet articles
Jewelry
Hair cuts, hair permanent
Cigars, cigarettes
Gifts and contributions

Farm families spent an average of ₱801 for goods and services for family living (table 11). Non-farm families spent ₱1,125. The biggest item for both families was food, while the lowest expense item was medical care.

Non-farm families spent a bigger percentage of their income in food compared to farm families. This difference might have been caused by the lack of the quantity and quality of home-produced foods compared with that enjoyed by the farm families.

Contrary to what was expected, this study showed that farm families spent a greater portion of their income available for family living for personal items than did non-farm families.

Farm families spent considerably less money for food and household supplies and consequently had more to spend on clothing, health and medical care, and advancement.

TABLE 11.—*Distribution of expenditures for family living*

ITEM	FARM		NON-FARM	
	Pesos	Per cent	Pesos	Per cent
Food	388	48	685	61
Household supplies	76	10	127	11
Clothing	74	9	71	6
Health and medical care	66	8	56	5
Advancement	93	12	73	7
Personal	104	13	113	10
Total average	801	100	1,125	100

The expenditures of disposable income, which is the cash available for family living after deducting farm and store expenses, are shown in table 12.

The amount available for family living includes the disposable income plus income in kind. Expenditure of this is shown in table 13. The relative importance of the various types of expenditures has been shown in table 11. The pattern was not consistent for all types of expenditures for different income groups (table 13).

Expenditures for food constituted about one-half or more of the average total expenditure for both farm and non-farm families.

TABLE 12.—*Expenditure of disposable income per family*

	INCOME CLASS									
	2,000 and above		1,500-1,999		1,000-1,499		500-999		Below 500	
	Amount	Per cent	Amount	Per cent	Amount	Per cent	Amount	Per cent	Amount	Per cent
Farm:										
Food	[a]	—	594	45	462	55	333	58	115	59
Household supplies	[a]	—	111	9	75	9	63	11	22	11
Clothing	[a]	—	147	11	84	10	59	11	22	11
Health and medical care	[a]	—	51	4	72	9	87	16	32	16
Advancement	[a]	—	249	19	63	7	87	16	24	12
Personal	[a]	—	184	14	104	12	63	11	22	11
Non-farm:										
Food	1,091	40	841	48	738	55	490	57	220	64
Household supplies	188	7	174	10	140	10	83	10	36	10
Clothing	159	6	99	6	58	4	35	4	14	4
Health and medical care	71	3	57	3	50	4	70	8	29	8
Advancement	112	4	133	8	49	4	60	7	17	5
Personal	243	9	150	9	103	8	58	7	22	6

[a] Too few to average.

TABLE 13.—*Expenditure per family of amount available for family living*

	INCOME CLASS									
	2,000 and above		1,500-1,999		1,000-1,499		500-999		Below 500	
	Pesos	Per cent	Pesos	Per cent	Pesos	Per cent	Pesos	Per cent	Pesos	Per cent
Farm:										
Food	[a]	—	988	58	732	62	512	66	252	73
Household supplies	[a]	—	131	8	81	7	69	9	33	10
Clothing	[a]	—	147	9	84	7	59	8	22	6
Health and medical care	[a]	—	51	3	72	6	87	11	32	9
Advancement	[a]	—	249	15	63	5	87	11	24	7
Personal	[a]	—	184	11	104	9	63	8	22	6
Non-farm:										
Food	1,173	41	899	50	768	56	528	59	336	76
Household supplies	212	7	178	10	147	11	145	16	64	14
Clothing	159	6	99	5	58	4	35	4	14	3
Health and medical care	71	3	57	3	50	4	70	8	29	7
Advancement	112	4	133	7	49	4	60	7	17	4
Personal	243	9	150	8	103	7	58	6	22	5

[a] Too few to average.

As income increased, there was a tendency for the percentage outlay for food to decrease in both family groups. At the same time, the actual peso expenditures for food increased with the income.

Among farm families, the percentage outlay for food was from 49 to 73 per cent, while among non-farm families it was 41 to 76 per cent. In both family groups, families with lower incomes tended to spend a higher percentage of their income for food. These family food expenditures illustrate Engel's law showing that a smaller proportion of the total expenditure at the higher income level was for food.

The percentage outlay for clothing varied in all income classes for both farm and non-farm families. Among non-farm families, as income decreased the percentage outlay for clothing tended to increase.

The actual peso expenditure of the low-income families was less than one-tenth that of the high income families. The farm families showed the same tendency except that the trend was not entirely consistent.

Expenses for education included allowance for children, matriculation and tuition fees, school contributions, payment for books and other school supplies and subscriptions to foreign and local magazines. Recreation included expenses for transportation, shows, dances and other activities for self-enjoyment.

No relationship was found between income and expenditure for education and recreation among farm and non-farm families. In all income groups, however, farm families spent a greater proportion of their income available for family living for education and recreation than did non-farm families.

Neither farm nor non-farm families spent much for health and medical care. The relation to level of income was consistent. As income decreased, there was an increase in the relative amount of outlay for health and medical expenses. Medical expenses consisted mostly of doctor's fees for consultation and drug store bills.

Personal expenses increased both in total amount and in percentage with the amount of income received for both farm and non-farm families. Contrary to what was generally expected, this study showed that farm families spent a greater portion of their income available for family living for personal items than non-farm families.

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